The impact of the ART approach on the treatment pattern in a public oral health service in South Africa

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Original Publications

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Mickenautsch S, Frencken JE, van't Hof MA. The effect of an Atraumatic Restorative Treatment (ART) training course on the restorative treatment pattern in Gauteng Province, South Africa. Afr J Oral Health 2007; in print.

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Mickenautsch S, Frencken JE, van't Hof MA. Factors inhibiting the implementation of the Atraumatic Restorative Treatment approach in public oral health services in Gauteng Province, South Africa. J Appl Oral Sci 2007; 15:1-8.

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CHAPTER 1

General introduction
and
Aim of the study

1. Demographics

The Republic of South Africa, situated on the southern tip of the African continent, is surrounded on its southern and eastern shores by the Indian and Atlantic oceans. To the north, the country is bordered by Namibia, Botswana and Zimbabwe. In the east, it shares borders with Mozambique and the Kingdom of Swaziland. In its south-eastern centre, South Africa completely surrounds the country of Lesotho. The total area of the country is 1 219 090 km^2 and is characterized by a large variety of geographical zones: high plateaus, mountains, semi-deserts, savannahs and subtropical coastal regions. In 2001, the population was estimated to be 44.8 million, originating from a variety of cultures, with 11 official languages. South Africa's main population groups are: 'Black African' (79%), 'White' (9.6%), 'Coloured' (8.9%), and 'Indian' (2.5%) (1). The Black African population comprises people of African origin, from the language groups: IsiNdebele, IsiXhosa, IsiZulu, Sepedi, Sesotho, Setswana, SiSwati, Tshivenda and Xitsonga. The main White language groups speak Afrikaans and English. There are also German, Greek and Portuguese minority groups. Most of the Coloured and Indian communities are Afrikaans and English speaking. Eighty percent of the population is under 44 years of age. There is an almost even distribution of women (52.1%) to men (47.9%) (1).

In 1994 the country overcame the system of apartheid and since then has become a democracy, with equal rights for all population groups. Today, South Africa is divided into 9 provinces, further divided into regions and districts. However, the number and extent of districts and regions within each province are still undergoing administrative changes.

2. Economy

South Africa represents only 3% of Africa's surface area but accounts for approximately 40% of all industrial output and 25% of its gross domestic product (GDP). South Africa's mining, manufacturing and retail industries compare favourably with their counterparts in Europe, America and Asia. However, the economic system is divided into a sophisticated industrial economy and an underdeveloped informal one. The first has great potential for further growth, whereas the second presents both untapped potential and

developmental challenges (2). These challenges are highlighted by the high unemployment rate: officially 26.7% of the country's economically active population (3). However, if the number of those who have given up looking for employment is included in the figure, the unemployment rate increases to 41.8% (2). The manufacturing, construction, electricity and water provision industries account for 24% of South Africa's economical activity; the mining industry, for 7% and agriculture, forestry and fishing, for 4%. Other industries include the financial, real estate and business service sectors (together 20%). In recent years, tourism has become an important sector (2).

South Africa's main budget revenue for 2004/5 was 38 billion Euros – an increase of 6 billion from 2002/3. With rising revenue, budget allocations for health services are also increasing: from 3.7 billion Euros (2002/3) to 4.6 billion in 2004/5. Budget estimates project a continued increase in expenditure for health services until 2008/9, to 6.9 billion Euros (4).

3. Health Services

Health service provision in South Africa is divided between a private and a public sector. Almost 16 % of South Africans are of the mid- and high socio-economic groups, have 3rd party insurance and can make use of private health services (5). Private oral health services offer sophisticated care and compare favourably with oral health services in the Western world.

Public healthcare delivery is based on the primary healthcare approach and organised on a decentralised district basis. Before 1994 the service was highly fragmented and bureaucratic, providing the White population with better healthcare than Black Africans received. Access to services in rural areas was inadequate. Furthermore, expenditure on tertiary care was prioritised above primary healthcare service (6). After 1994, the Government of National Unity of the New South Africa adopted a decentralised healthcare system, which shifted power, authority and control over the allocation of resources from the national, to the district level. The purpose was to achieve greater equity and efficiency, greater community involvement, bureaucracy reduction and greater coordination between social sectors (6). On the basis of decentralisation, management at national level sets norms and standards and monitors service delivery. The provincial management is charged with service planning and

regulation according to national standards. District management is responsible for rendering public health services (6).

4. Public oral healthcare

Oral healthcare delivery is an integral part of the public health services provided. According to the Department of Health, the integration of oral health services into district health service systems resulted in an inability to provide information on oral health budgets for some provinces. However, available data show expenditure for oral health services in 7 of the 9 provinces in 2000/2001 to have been between 0.7 – 4.8 million Euros (7).

Reports from 1988/9, 1995 and 2004 show that over 80% of South Africans rely on public oral healthcare (5,8,9). According to the latest available data, these services are rendered at 490 full-time, and 322 part-time operating dental surgeries. Seventy-five percent of full-time operating surgeries are situated in urban, and only 25% in rural areas. In 1999 a total of 131 surgeries were not utilized, owing to a critical shortage of dental operators (8).

In 1995, 453 dental operators (dentists, dental therapists and oral hygienists) were employed by the state (9), and 368 in 1998 (8). In 1997 legislation was passed to introduce Compulsory Community Service (CCS). The purpose of this legislation was to help eradicate operator shortages in the public health sector by making remunerated community service, particularly in rural and disadvantaged areas, compulsory for dental graduates (10). Starting in 2000, about 200 dentists joined the services every year, for a period of 12 months after graduation (11).

A long existing general lack of resources has been put forward as the main reason for the low number of dental operators in the public services, and for adjusting the services into an oral care delivery system that responds adequately to treatment needs and demands (12). Bhayat and Cleaton-Jones suggest that the insufficient number of dental operators is not due to a general lack of personnel in the country, but to a relative shortage of posts in the public service (13).

The lack of an adequate number of dental operators has resulted in high workloads. In 1996 free dental care in state hospitals and clinics was introduced, with a resultant increase in attendees at state clinics (13). In 1999

each dental operator provided, on average, over 4 400 oral treatment procedures per year (8). Pain relief and the provision of antisepsis treatment were the main provisions of the oral healthcare system. The most common treatment procedure in public dental clinics today is tooth extraction (74%) (8). Although public oral health clinics are generally equipped with instruments and materials needed for placing traditional restorations, the number of restorations to extractions is low (0.11) (8). Further rendered treatment score ratios in relation to tooth extractions (8) are presented in Table 1.

The Department of Health developed a number of strategic oral health objectives at the end of the 1980s (14). These include:

- To ensure that 60% of the 20-year age group will retain all their teeth (excluding 3rd molars);
- To reduce the edentulous population, amongst the 35 to 44-year age group from 10.4 to 6.2%;
- To reduce the edentulous population, amongst the 60 to 64-year age group, from 26.9 to 21,4%.

Table 1: Scores of treatment ratios of treatments rendered, to tooth extractions

Treatment	Score
Preventive measures, such as topical fluoride application	0.14
Scaling and polishing	0.04
Minor surgical procedures	0.02
Prosthetics	0.01
Endodontics	0.01
Orthodontic treatment	0.01

These goals were revised in 2004 and the current oral health goals for 2010 include (15):

- An increase in primary healthcare facilities for delivery of oral healthcare;
- An increase to 50% in the percentage of caries-free children aged 6;
- Reduction to 1.0 in the mean DMFT score at age 12.

In order to realise its goals, the Department plans to provide access to optimally fluoridated water for 60% of the population that receive piped water. In 2000 legislation was passed requiring water service providers to fluoridate water to a level of 0.7 ml F^-/l, with effect from September 2003 (16). It has been estimated that the caries preventive effect of water fluoridation may decrease the demand for public oral health services in the South African metropolitan areas by 20-40% within a period of 5-15 years (9). In addition, water fluoridation is meant to benefit populations residing in rural areas, who do not use fluoridated toothpaste (16). In contrast, South African water service providers have questioned the effectiveness of water fluoridation on the basis that most people in rural areas have no access to piped water. The national cost of fluoridating water is estimated to be 3.2 Million Euros per year. As only 0.65% of piped water is used for drinking purposes, water fluoridation is not considered to be cost-effective. It is, therefore, currently argued that funds used to pay for fluoridation of piped water should rather be used to extend the provision of free piped water to South Africans (16).

Beside the fluoridation of water, community oral health promotion activities of the Department of Health are concentrated on school oral health programmes. These comprise oral screening, tooth brushing sessions, fluoride mouth rinsing and oral health education classes for children in primary schools. Currently, these activities are criticised as being inefficient for improving oral health, since the necessary parental and social support is lacking (7).

Apart from the preventive and promotional programmes described above, the Department of Health also plans to strengthen basic curative services by ensuring that all clinics offer a standardized primary oral healthcare package (15). This includes basic treatment services, consisting of

oral examinations, taking of bitewing radiographs, scaling and polishing, provision of emergency pain and sepsis relief and placing of simple (1-3 surface) restorations (17). It has been suggested that the ART approach be included into this package (16,18).

5. Oral health situation

5.1 Dental caries status

Black Africans constitute the main population group of South Africa (79%). Whilst caries data about the White, Colored and Indian minorities are also of interest, information on the dental caries status of the Black African group provides a more relevant overview of the oral health situation in South Africa and is, therefore, taken as the focus of the dental caries situation that is described below.

A search in the PubMed database was conducted in English, using the keywords: 'dmft OR DMFT AND South Africa', as well as 'caries AND South Africa'. The search resulted in dmft scores of 6-year-old, and DMFT scores of 12-, 15- and 35-44-year-old, Black Africans, collected from eight studies conducted between 1981 and 2004 (19-26). The weighted mean dmft scores of the 6-year age group and the weighted mean DMFT scores of all other age cohorts have been calculated and are presented in Figure 1.

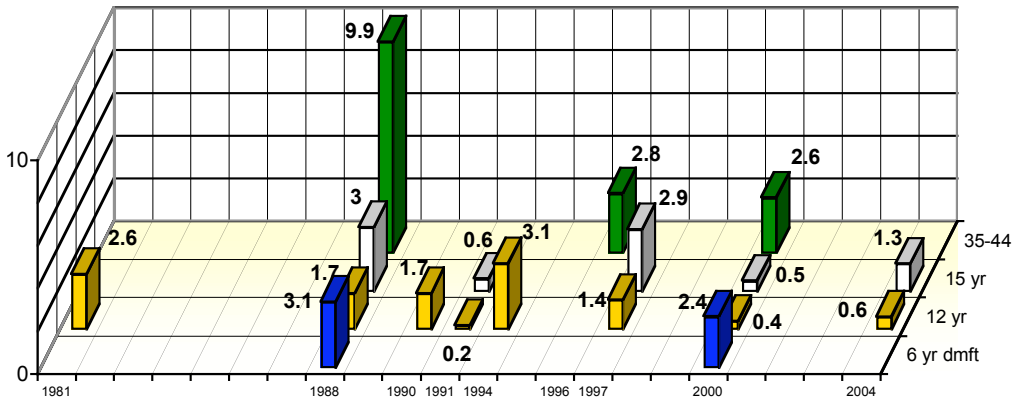

Figure 1: *Weighted mean dmft/DMFT scores of Black Africans in South Africa from 1981 – 2004 by age cohorts. The y-axis represents the weighted mean dmft/DMFT score; the x-axis represents a specific age cohort and each z-axis shows an age group.*

Only two studies have reported on 6-year-old children. The weighted mean dmft scores were 3.1 in 1988, and 2.4 in 2000. Results show a low level of dental caries experience according to the WHO classification, particularly in the most recent study (19). Most of the retrieved studies were carried out amongst the 12-year olds. Considering the caries experience in this age group in a time perspective, the weighted mean DMFT score was 2.6 in 1981, and 0.6 in 2004. The weighted mean DMFT score in 1991 was 0.2 and that of 1994 was 3.1. These results show great variations rather than a constant trend. The weighted mean DMFT scores for the 15-year-old age group also show variations over time: 3.0 in 1988, 0.6 in 1991 and 2.9 in 1997. In recent years, the scores have been lower than in earlier years: 0.5 in 2000 and 1.3 in 2004. The adult Black Africans in the 35-44 years age group showed a high weighted mean DMFT score of 9.9 in 1988. However, in 1997 and 2000 the weighted mean DMFT scores were much lower: 2.8 and 2.6, respectively. In the absence of (mixed) longitudinal studies it is impossible to assess the validity of the observed changes.

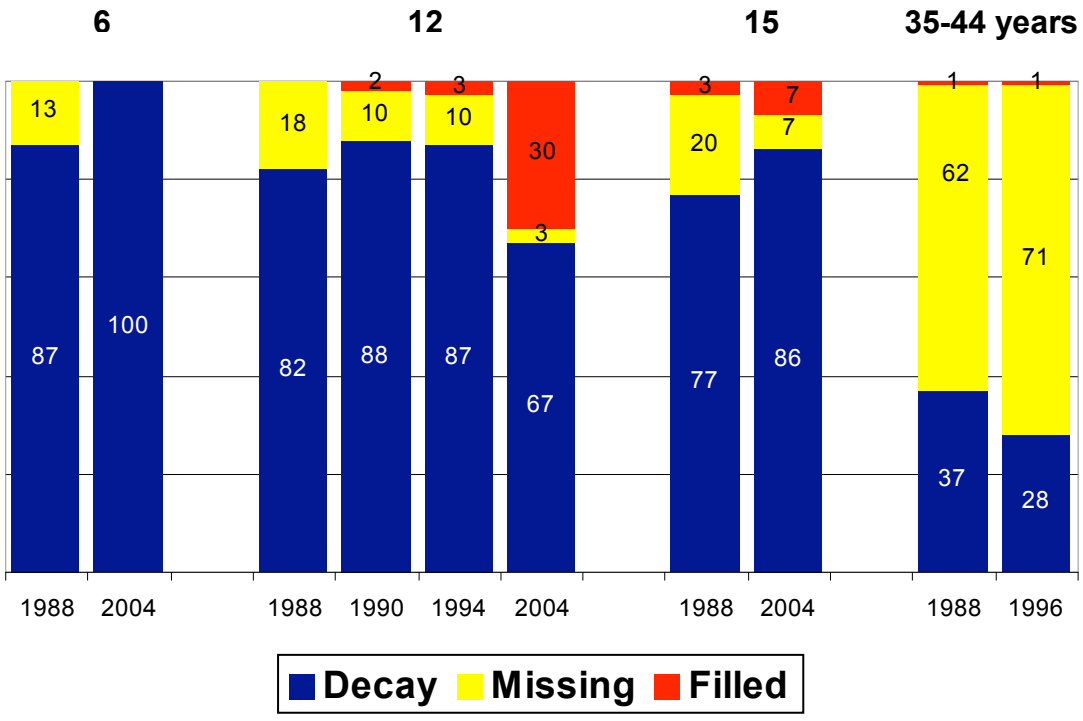

Figure 2: *Proportional distribution of dmft components (%) in 6-year olds and DMFT components (%) in 12- and 15-year-old children and in 35-44-year-old adults from the Black African population groups by year of investigation.*

Considering the caries findings presented in Figure 2, it is clear that the d/D-component is predominant in the 6-, 12- and 15-year age group, whereas the M-component predominates in the 35-44-year age group. The F-component is low in all age groups, with the exception of the 12-year-old group studied in 2004. The results of these studies seem to indicate that the majority of Black Africans lived with cavitated dentine caries lesions in teeth and that extraction, rather than restoration, must have been the treatment of choice. It is obvious that they must have had scant access to, or made little use of preventive and restorative oral healthcare services in the past. Although Coloured and Indian population groups were also disadvantaged by the former political system, the mean DT scores were lower and the mean FT scores higher than those of the Black African population in the 35-44-years age group of both population groups, in the 1988/9 national study (Table 2). This indicates that Blacks were the most disadvantaged in former times (14).

Since 1994 the new South African government has aimed to provide equal access to health services for all population groups. However, in 1998, the public oral health service was described as palliative, without a structured budget and without functional concepts (8). Until today the aims of the South African government remain constantly challenged by a lack of resources for oral healthcare in the public service.

Table 2: Mean DMFT scores and standard deviation for South African population groups (35-44-year age)

Population group	Mean scores			
	DT	MT	FT	DMFT
Black African	3.7 ± 4.4	6.1 ± 6.8	0.1 ± 0.3	9.9 ± 7.9
Coloured	1.5 ± 2.8	22.7 ± 11.1	0.4 ± 1.6	24.6 ± 9.3
Indian	2.8 ± 3.7	7.4 ± 7.1	1.4 ± 2.8	11.9 ± 7.8
White	0.7 ± 1.5	10.9 ± 10.8	8.3 ± 6.5	19.9 ± 7.5

5.2 Periodontal profile

The National Oral Health Survey of 1988/89 recorded the periodontal profile of the various South African population groups living in urban areas (Table 3) (14). Like the dental caries status, the periodontal profile shows a higher disease level in the previously disadvantaged groups (Black African, Coloured and Indian) as compared to the White population group. The number of healthy sextants amongst Whites exceeds the number of those in people from all the other groups combined**.** This further indicates a lack of access to preventive and curative oral healthcare services for the Black African, Coloured and Indian groups in the past, in addition to a low level of self care. These findings are also supported by subsequent treatment needs per population group (Table 4) (14).

The highest percentage of people not requiring periodontal treatment was found among the White population and the lowest, in the Black African population group. Among all the groups, Whites also have the fewest periodontal treatment needs. Black Africans have the highest needs for prophylaxis and complex treatment. Since Black Africans were socio-economically disadvantaged, most have to rely on periodontal treatment offered by the public oral health service.

Table 3: Mean number of sextants affected per person for South African population groups (35-44-year age)

Population group	Mean number of sextants				
	Healthy (Code 0)	Bleeding (Code 1)	Calculus (Code 2)	Shallow pockets (Code 3)	Deep pockets (Code 4)
Black African	0.4	0.5	4.0	0.6	0.2
Coloured	0.2	0.3	3.4	0.4	0.1
Indian	0.4	0.6	3.8	0.6	0.6
White	2.3	0.6	2.5	0.3	0.0

5.3 Perceived oral health problems and utilisation of care

In South Africa the unmet dental treatment needs are high. For example, the unmet restorative care needs of 6- and 12-year-old children are 96% and 89% respectively, and for adults aged 35-44 years, 73% (5). This high level of unmet restorative care leads to a high level of toothache. It has been reported that 70% of schoolchildren aged 8-10 years, in the Western Cape Province of South Africa, not only suffer from toothache daily, but have missed time at school as a result of it (27). National figures show that 38% of 35 – 44 year-olds experience dental pain, of which 81% is attributed to untreated caries lesions, and 7% to gum disease (28). Gum problems are more prevalent in urban (10%) than in non-urban areas (5%). Although the oral health problems in the high education group are generally reported to be low, this group apparently suffers more from gum problems (22%) than people from the lower education group (4%) (28). Not only the education level, but also the socio-economic background, plays a role in the perception of oral health and care utilisation. For the formerly disadvantaged population groups in South Africa, a symptomatic issue, such as pain caused by a decayed tooth, appeared to be the main reason for visiting a dentist (29).

Table 4: Percentage of people with treatment needs per population group (35-44-year age)

Population group	No treatment	Type of treatment		
		Oral hygiene instruction	Prophylaxis	Complex treatment
Black African	0.0%	98.6%	97.9%	10.1%
Coloured	0.7%	97.1%	97.1%	2.9%
Indian	0.6%	99.1%	96.1%	4.5%
White	8.2%	91.8%	84.2%	1.2%

The demand for tooth extractions, from the Black African, Coloured and Indian population was 41%, 21% and 36% respectively, whereas the demand for restorations was 13%, 21% and 36%, respectively. In the past these groups did not have the same access to modern health services as the White population group enjoyed. The percentage of restored teeth in White South Africans (30%) was higher than that of tooth extractions (4%) (30). It is expected that as exposure to the newly established services will increase, so will the demand for tooth restorations, in formerly disadvantaged population groups.

6. Study rationale

So far, a number of remarkable features in the delivery and accessibility of oral health services in South Africa have been identified. For example; it has been shown that tooth restorations to extractions are rendered at a ratio of one to nine, despite the availability of equipment for restorative treatment with amalgam (8). The high percentage of tooth extractions leads to high premature tooth loss in primary and permanent dentition. Early tooth loss may result in orthodontic and surgical complications. It also leads to masticatoric, phonetic and aesthetic deprivation of patients (31,32). Furthermore, the need for restorations is almost twice as high as it is for extraction (33). At present the number of staff employed in the public dental service is insufficient for adequate response to all treatment needs. This, in turn, leads to high workloads, in which treatment of pain and sepsis overrides other treatment requirements. Under the present work conditions traditional approaches of cavity restoration with available equipment and materials appear to be not the most appropriate for meeting the restorative treatment needs. All the prevailing circumstances, mentioned above, hinder the attainment of the goals set by the South African National Department of Health (15). Therefore, a more appropriate approach needs to be implemented.

One new caries management concept, the Atraumatic Restorative Treatment (ART) approach has gained the attention of the oral health authorities (34). ART uses hand instruments for managing cavitated caries lesions and uses glass ionomer restorative material to seal caries-prone pits and fissures. Research has shown that ART is less threatening to patients

than conventional treatment approaches (35,36). Owing to its minimally invasive nature, ART appears to have the potential to increase patient acceptance of restorative care and consequently, to reduce patient anxiety, which is often considered an inhibitor of restorative treatment. A positive impact of the ART approach, on the provision of preventive and restorative treatment, would help the Department of Health to achieve the national oral health goals.

6.1 The Atraumatic Restorative Treatment (ART) approach

The ART approach is appropriate for restoring tooth cavities, as well as for protecting pits and fissures against caries development (34). When cavities are restored with ART, a hand excavator is used to remove carious tooth tissue. The cleaned cavity is then conditioned with a weak organic acid and the cavity is filled with an adhesive material. So far, glass ionomer has been the restoration material most commonly used. Research has shown high mean survival rates for single-surface ART restorations using high-viscosity glass ionomer cement (GIC): 86% after 3 years in primary teeth and 72% after 6 years in permanent teeth (37). Recently, restorations placed using the ART approach, using a high-viscosity glass ionomer, were reported to be surviving longer than comparable restorations produced through the traditional approach using amalgam, after 6.3 years (38).

The high-viscosity glass ionomer is also used to place ART sealants. The glass ionomer is applied onto cleaned pits and fissures and pressed down under finger pressure. Results of a recently published meta-analysis showed a weighted mean percentage of partially and fully retained ART sealants, of 72% after 3 years in the permanent dentition, whereas the weighted mean percentage of caries-free pits and fissures was 97% after 3 years (35). Initial findings suggest that high-viscosity glass ionomer ART sealants have a four times higher chance of preventing caries than do resin based fissure sealants (39).

Research that has studied ART has shown it to be more acceptable to patients than the traditional approach of using rotary equipment, suctioning saliva and drilling teeth (40-45). This is particularly applicable to children because with ART, local anaesthesia injection is hardly required (40). Another

important reason why ART was considered suitable in the South African oral health context was its cost. A cost-benefit calculation of various restoration models in a modern dental clinic environment in South Africa has shown that the annual capital cost for the ART approach is approximately 50% that of composite and amalgam restorations (46). A recently published Report described the cost-effectiveness of restorations produced through ART and the traditional treatment approach for 3 Latin American countries. ART restorations were more cost-effective than amalgam restorations after 2 years (47).

The clinical, laboratory and socio-psychological studies obtained so far, and the early implementation research, warrant a study on the introduction of ART into the South African public oral health service.

6.2 Aim and objectives

The aim of the present PhD research was to investigate the effectiveness of introducing the ART approach, on the tooth restoration and extraction pattern in a provincial public oral health service system in South Africa.

Currently, most of the published ART studies have been concerned with clinical aspects of the approach. On the basis of its high survival rates and low-cost nature, ART has been recommended as being appropriate for public oral health services in developing countries (19, 48, 49). Only one paper which investigated the experience of dental operators who had used ART in a public oral health service system has been published. This study reported a high preference rate of 91.4% amongst dental operators in the Tanzanian public oral health service. However, several problems, such as insufficient training and practice in ART were suggested (50). Nevertheless, no other studies have investigated in more detail the implications of introducing ART into public oral health services in a developing country.

On the basis of the reported atraumatic properties of ART (40 – 45), its quality of single-surface restorations (35) and its higher survival rate compared to amalgam restorations (38), a positive change was expected in the number of restorations placed in relation to the number of teeth extracted.

In order to investigate such effect of ART, this PhD research included the following objectives:

- To investigate the impact of ART on the treatment profile in a model community oral health service setting;
- To describe the tooth restoration and extraction pattern in a South African provincial public oral health service not using ART and to investigate operator opinion about their perceived stress;
- To evaluate the effect of a standard ART training course on the treatment pattern of dental operators in a South African public oral health service system;
- To investigate the effect of ART on patients' dental anxiety and the consequences relating to the tooth restoration and extraction pattern in a South African public oral health service system;
- To investigate potential barriers to utilising ART in a South African public oral health service system.

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CHAPTER 2

The impact of the ART approach on the treatment profile in a mobile dental system (MDS) in South Africa

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This chapter is a modification of the publication by Mickenautsch S, Rudolph MJ, Ogunbodede EO, Frencken JE. The impact of the ART approach on the treatment profile in a mobile dental system (MDS) in South Africa. Int Dent J 1999; 49:132-8.

Abstract

The changing profile of oral care rendered through the Mobile Dental System (MDS), after the introduction of the Atraumatic Restorative Treatment (ART) approach, is described. The treatment profile of a one-year period before the introduction of ART and the treatment profile during the first year after introduction of ART were compared. After introduction of ART, the overall mean restoration/extraction ratio (REX) increased from 0.37 to 1.15. This was due to a significant decrease in the percentage of tooth extractions and a significant increase in the percentages of restorations in both dentitions ($p<0.0001$). For the combined posterior permanent and primary teeth only, a comparable increase in the mean REX score was observed (from 0.41 before to 1.27 after ART introduction). The proportion of ART restorations to the total number of restorations was 98.2%. These changes are partly ascribed to a change in choice of treatment by dental operators, in favour of ART. The one-year survival of one-surface ART restorations using Fuji IX and KetacMolar was 93.6%. Full and partial (more than 90%) retention of the sealant extension to ART restoration was obtained in 75% of the cases after one year. During the one-year period, infection control was made simpler and this facilitated easier maintenance of mobile dental equipment. The introduction of the ART approach reduced extraction, increased tooth restoration and made oral care in the MDS more preventive.

Introduction

Since 1985, the Department of Community Dentistry, Faculty of Dentistry of the University of the Witwatersrand has managed and provided a Mobile Dental Service (MDS) programme to communities with low socio-economic backgrounds around Johannesburg, using a Mobile Dental Unit (MDU) (1). In line with the Primary Health Care (PHC) approach (2), the programme aims to demonstrate appropriate technologies for oral healthcare delivery in communities having limited or no access to oral care, and to investigate their efficacy. The structure of the MDU has been described previously (3). The unit consists of four fully equipped dental clinics and is operated by a team of oral health workers, which includes a dentist, two dental therapists, a dental assistant and support staff. Once deployed, the MDU remains in a community for several weeks and is then moved to another. Communities are chosen on a logistical basis at the beginning of each year and thus may differ from year to year. In the communities the oral health workers provide comprehensive oral care comprising tooth extractions, restorations, fissure sealants, topical fluoride application, scaling and polishing, as well as surgical tooth removal and dry socket treatment. This service is open to all community members and also includes oral health education and oral screening in community schools and referral of children, upon parental consent, to the MDU for treatment. Most communities are distant from the University and thus require the oral health workers daily to spend long hours in travelling to them. For that reason, services are only rendered for 4-5 hours per day.

After the introduction of the Atraumatic Restorative Treatment (ART) approach in South Africa in 1996, ART was also included into the MDS in order to investigate the efficacy of the approach under mobile dental service conditions in disadvantaged communities. ART is able to provide preventive and curative care using hand instruments only without the use of electricity (4); it is considered child-friendly and results in a sealed restoration. ART has gradually been adopted by all members of the MDS-team and it currently constitutes a major treatment option.

As the filling material is such an integral component of the technique, an existing, and a new, glass-ionomer were used in the application of ART. The purpose of this paper is to report the impact of ART on the treatment

profile within the MDS and to report the success of ART restorations after one-year.

Materials and methods

Oral services data collection

All oral procedures rendered through the Mobile Dental System (MDS) were recorded. Three data collection periods of one-year each could be distinguished. These were: A) before ART was introduced (1 February 1995 to 31 January 1996); B) during gradual introduction (1 February 1996 to 31 January 1997) and C) after ART had been fully included (1 February 1997 to 31 January 1998). No other major change had taken place in the treatment rendered. The staff complement was stable throughout the three periods and they were free to choose the treatment and restorative material that they thought fit for treating caries.

ART impact study

The impact of the ART approach on the services provided was assessed by calculating the mean scores of the restoration/extraction ratio (REX) for all teeth, and separately for posterior primary and permanent teeth in periods A and C. Moreover, the proportion of ART restorations to the total number of restorations and the proportion of each type of treatment of the total number of rendered treatments were calculated for each period and compared. ART restorations were placed according to the ART manual, using the 'press-finger' technique (5).

In order to investigate reasons for changes, operators were interviewed using a five-point structured questionnaire (Annex 2). Questions were related to the length of time that they had worked in the MDU, their personal choice in treating primary and permanent teeth and their reasons for choosing a particular treatment procedure.

Quality of ART restorations

As part of its services to communities, the MDS provides oral healthcare to community schools. During period C, seven primary schools situated on farms north of Johannesburg were included. All of these schools constituted the

study frame for the ART quality study. A total of 1325 children were examined by the dentist (SM). These children constituted a sub-group of all subjects included in the ART impact study during period C. Caries was scored according to the criteria described by Frencken *et al*.(6). Dean's index was used to score fluorosis (7). The study selection criteria included the following: age (between 6 and 11 years), absence of fluorosis, presence of one-surface cavity without exposed or infected pulp in permanent teeth, and capacity of the opening of the cavity to allow the smallest excavator to enter. Only children whose parents had given consent received treatment. Children with parental consent who did not fulfil the study criteria were treated according to the standard protocol of the MDS programme. The study proposal was accepted by the Committee for Research on Human Subjects (Medical) of the University of Witwatersrand.

Two glass-ionomer restorative materials were used. These were Fuji IX (GC) and KetacMolar (ESPE). The selection of cavities for the two material groups was carried out using the split-mouth technique for those children with more than one cavity. For those with one suitable cavity, the selection of the material group was made at random, using a name list. There were three operators; one dentist and two dental therapists. To be able to assess the sealant extension part of the ART restoration, operators were instructed to draw the sealed restoration on the treatment form. The drawing showed the sealant extension and the actual restoration. The one-year evaluation was carried out by an independent evaluator. The restorative and sealant parts of the ART restorations were evaluated separately, using the criteria described by Frencken *et al*. (8).

The treatment rendered was part of the overall MDS treatment profile investigated in the ART impact study. Treatment procedures were analysed separately for primary molars and permanent posterior teeth. With respect to the quality of ART restorations, differences in success between the two types of glass-ionomers were determined. Differences were analysed with the Chi-squared test, using Epi Info Version 6 (9).

Results

ART impact study

The treatment profile before and after the introduction of ART is presented in Table 1. An increase in restorative care from 18% in period A to 46.3% in period C and a proportional decrease in most other types of treatment given could be observed in period C. In that period, ART was the most commonly rendered type of treatment (45.4%). The proportion of ART to the total number of restorations was 98.2%. The proportion of traditional, more invasive types of restorative care, was reduced from 100% in period A to 1.8% in period C. The overall mean REX score increased from 0.37 in period A to 1.15 in period C.

Figure 1 shows the mean REX score in both posterior permanent and primary teeth before and after the introduction of the ART approach. An increase of the mean REX score in both dentitions was observed in period C, with the increase for the primary dentition being higher than for permanent teeth.

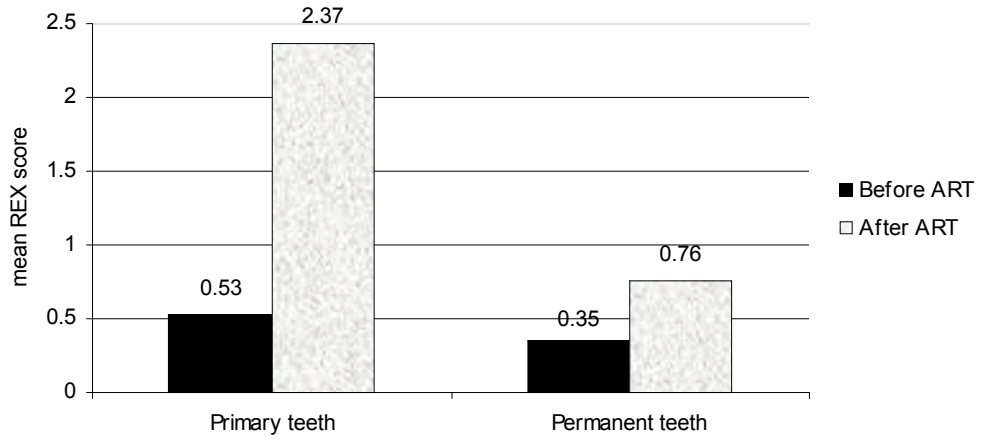

Figure 1: *Comparison of mean REX scores in posterior teeth before and after the introduction of the ART approach*

The percentages of carious premolars and molars treated using amalgam, glass ionomers through ART, and extraction before and after the introduction of the ART approach, are presented in Table 2. No composite restorations were placed in posterior teeth before or after the introduction of ART. There was a statistically significant difference in numbers and percentages of tooth extractions both in permanent ($P<0.0001$) and in primary dentitions ($P<0.0001$) between periods A and C. A higher utilization of ART in primary (70.3%) than in permanent posterior teeth (43.2%) was observed. Only one amalgam restoration was placed after the introduction of ART.

The questionnaire revealed that all dental operators (two dental therapists and one dentist) had worked on the MDS before and after the introduction of the ART approach. In response to specific questions relating to the use of the ART approach, all respondents indicated ART restoration as their present choice of treatment for carious single- or multiple-surface lesions of premolar and molar teeth without infected or exposed pulp. The reasons given for this choice included: the lower overall cost of ART restoration; the improved properties of glass-ionomer cements; the absence of the need to use local anaesthetics, noisy drills and suction in the ART approach; the potential toxicity of amalgam.

Table 1: Treatment profile before (Period A), and after (Period C)

TYPE OF TREATMENT	PERIOD A (Before ART)		PERIOD C (After ART)		% Difference
	No.	%	No.	%	
Amalgam restoration	170	5.1	1	0.1	-5.0
Composite restoration	102	3.0	15	0.8	-2.2
Glass-ionomer for period A/ ART restorations for period C.	331	9.9	869	45.4	+35.5
Tooth extractions*	1612	48.2	769	40.2	-8.0
Root extractions	177	5.3	131	6.8	+1.5
Fissure sealing	311	9.3	9	0.5	-8.8
Scaling	311	9.3	64	3.3	-6.0
Fluoride application	18	0.5	4	0.2	-0.3
Polishing	282	8.4	6	0.3	-8.1
Other types**	32	1.0	45	2.4	+1.4
TOTAL	3346	100.0	1913	100.0	
Total number of restorations	603	18.0	885	46.3	
Mean REX score	0.37		1.15		
Proportion of ART to total number of restorations (%)			98.2		

* Includes anterior teeth

**Includes surgical tooth removal, dry socket treatment

Table 2: Treatment rendered for carious single- or multiple-surface lesions in posterior teeth before and after the introduction of the ART approach into the MDS

TREATMENT		PERIOD A (Before ART)		PERIOD C (After ART)		% Difference	
		No.	%	No.	%		
	PERMANENT DENTITION*						
	Amalgam restoration	161	16.1	1	0.1	-16.0	
	Glass ionomer for period A/ ART restorations for period C	98	9.8	296	43.2	+33.4	
	Tooth extractions	742	74.1	389	56.7	-17.4	X^2=320.0, df=2, p<0.0001
	Total	1001	100.0	686	100.0		
	PRIMARY DENTITION						
	Amalgam restoration	9	1.4	0	0.0	-1.4	
	Glass ionomer for period A/ ART restorations for period C	210	33.2	427	70.3	+37.1	
	Tooth extractions	414	65.4	180	29.7	-35.7	X^2=174.6, df=2, p<0.0001
	Total	633	100.0	607	100.0		
	PERMANENT AND PRIMARY DENTITION COMBINED						
	Amalgam restoration	170	10.4	1	0.1	-10.3	
	Glass ionomer/ART restoration	308	18.9	723	55.9	+37.0	
	Tooth extractions	1156	70.7	569	44.0	-26.7	X^2=500.9, df=2, p<0.0001
	TOTAL	1634	100.0	1293	100.0		
	Mean REX score	0.41		1.27			

*Includes premolar teeth.

Quality of ART restorations

The prevalence of caries amongst the 1325 children examined was 36.4% and the mean DMFT score was 1.1. A total of 163 one-surface ART restorations, 82 with Fuji IX and 81 with KetacMolar, were placed in 113 school children aged 6-11 years (mean 10.5 years). The majority of the restorations were placed by the dentist. The number of children who received ART restorations with Fuji IX only, KetacMolar only and both was 39, 38, and 36, respectively. Twenty five children received one of each and one child received two restorations with both materials. The vast majority of ART restorations (95.7%) were placed in molars. The total attrition up percentage after one-year was 34%; 29.3% for Fuji IX and 38% for KetacMolar restorations.

The percentage of successful ART restorations after 1 year was 93.5%. There was no statistically significant difference in success rate between ART restorations using Fuji IX and those using KetacMolar (93.1% vs 94.0%, respectively). Loss of marginal integrity of more than 1 mm was the reason for failure of three ART restorations and complete loss of restoration was observed in four cases. Caries was not observed in relation to ART restorations.

Sealant extension to ART restoration

The sealant part was either fully or more than 90% retained in 75% of ART restorations at the one-year evaluation. The sealant extension was completely lost in 15.8% whilst less than 90% was retained in 3.7% of ART restorations. The sealed surface of six (5.5%) ART restorations could not be assessed.

Discussion

Due to the mobile nature of the MDS, different communities were included during periods A and C. Communities visited by the MDS during period C utilized the mobile dental service less, presumably due to lack of awareness, thus resulting in a lower number of total types of treatment than in period A. However, all communities were of the same low socio-economic background and the MDS staff complement did not change, being the same during both periods. The attrition of subjects included in the ART quality study after one-

year was high. For social and political reasons, many families had to move to different areas and could not be traced during the evaluation period.

The ART impact study showed that significantly fewer teeth were extracted during period C than in period A, when only conventional treatment packages for tooth restoration were used. An increase in restorative care in proportion to other types of treatment was, moreover, observed. Both the decrease in tooth extractions and the increase in restorations led to a higher mean REX score in period C. This suggests that the introduction of ART increased restorative care.

The increase of the mean REX score was much higher for primary posterior teeth then for permanent posterior teeth. A possible explanation for this difference is that children generally respond more fearfully to invasive dental treatment than adults do, thus providing a much stronger incentive for operators to use ART for children than for adult patients.

An advantage of the reduced extraction of primary molars is the prevention of malalignment of permanent teeth, which is often due to drifting or over-eruption of neighbouring or opposing teeth. Also, the early loss of permanent molars may result in limitations in chewing and spasms of masticatory muscles, with problems of the temporomandibular joint (10). Such complications impose a heavy burden on patients from disadvantaged communities, who lack the financial means for subsequent orthodontic or other complex treatment. Tooth extraction is the predominant oral care procedure provided by both dentists and dental therapists in most less-developed regions and under-served communities, resulting in a low mean REX score (4,11). Tooth extraction (48.2%) was also the treatment most often rendered as part of the dental services provided by the MDS between February 1995 and January 1996 (Period A). However, after the full integration of ART, an increase in the mean REX score was demonstrated.

The adoption of the ART approach in the MDS also resulted in a significant reduced number of amalgam restorations. Only 0.1% of all types of treatment rendered involved amalgam restorations. While amalgam restoration has been an everyday part of the practice of dentistry for more than 150 years (12), the ART approach is only a recent innovation. Therefore, the familiarity of the clinician with amalgam may make the choice of using

ART a difficult one. In a recent review of the materials and techniques for direct intra-coronal restorations in posterior teeth, Dunne *et al*. (13) concluded that amalgam should be used only where it offers clear advantages over other materials. However, there are indications that the usage of amalgam as a restorative material should be reduced, not for oral health, but for environmental reasons (14). The three-year survival rate of 85-88% for one-surface ART-restorations in the permanent dentition is similar to that of amalgam restorations placed under similar conditions (15). The one-year survival percentage of 93.5% for one-surface ART-restorations in the permanent dentition using the two glass-ionomers in the present study is comparable with that of earlier studies (15,16). Failures were related to material and operator factors and no new carious lesion was observed on the filled surfaces.

This is the first field study that has assessed the quality of the sealant extension part of ART restorations. A full and partially (more than 90%) retention of 75% of the sealant element was promising. It indicates that drawing the sealed ART restoration on the form is an acceptable manner of assessing the sealant part of ART restorations in a field setting.

During the period February 1997 to January 1998, the major types of treatment rendered were ART approach ones (45.4%). Tooth and root extractions were 40.2% and 6.8% respectively. Together they made up 92.4% of the total treatment provided. None of these oral health procedures were dependent on hand pieces, suctioning or water-cooling. Due to the difficult terrain in which the MDS usually operates (informal settlements or farm schools), appliances like hand pieces, water cooling and suction often fail to function for various reasons. These appliances would be more easily maintained if the need for their use were reduced, as in situations where ART constitutes the predominant restorative procedure.

The use of the ART approach in the MDS allowed for more effective and simple infection control, eliminating the need for hand piece sterilisation and disinfection of the suction system after treating each patient. In view of the widespread prevalence of HIV/HBV positivity (17,18), these procedures are necessary but often difficult to implement in dental outreach programmes like the MDS.

One of the difficulties experienced by the MDS is the erratic supply of electricity. ART is capable of improving the oral health not only of those people living in areas where electricity is unavailable, but also of those who live where there is electricity but few can afford and maintain expensive dental equipment (4).

It has been reported that many children responded fearfully to dental treatment delivered by the MDS (19). In addition, staff members indicated that they had difficulty in treating children. The ART approach applied in the MDS created a non-threatening entry into oral healthcare for the young and the adults and has redirected treatment towards a more preventive and patient-friendly approach.

The Alma-Ata declaration recognises the strategic and indispensable role of appropriate technology in healthcare delivery (2). The ART approach is based on the principle of appropriate technology and represents a practical, scientifically sound treatment method for dental caries, provided at a cost that most communities of the world can afford. The simplicity and minimal cost of the approach makes the control of dental caries feasible in all communities, irrespective of their socio-economic and living conditions. The ART approach, therefore, has the potential of contributing significantly towards making restorative treatment available to many population groups previously without dental care; especially, but not only, in rural and peri-urban areas of developing countries. However, the ART approach should not be provided in isolation but should be part and parcel of an integrated package that, besides pain relief, further involves education, plaque control and other preventive measures.

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CHAPTER 3

Restorative care and service conditions in a South African provincial oral health service system

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This chapter is a modification of the publication by Mickenautsch S, van't Hof MA, Frencken JE. Oral health service systems in Gauteng Province, South Africa. East Afr Med J 2007; 84:178-82.

Abstract

The research aimed to investigate the provision of restorative care and dental operators' opinions about conditions of service in a South African provincial oral health service system. Public oral health service dental operators in Gauteng Province, South Africa, were assessed over a 4-month period. Operators were interviewed and treatment statistics were collected. The mean score of restoration-extraction ratio per operator was calculated. The main outcome measures were: number and type of restorations and tooth extractions rendered, daily patient loads, perceived occupational stress levels and opinions about main reasons for operator stress. In total, 88 705 patients had been treated. The mean number treated daily was 26 (SD=8.4) per operator. The main type of dental treatment was extraction. Operators extracted 39 242 teeth and placed 2 992 restorations. The mean score of the restoration-extraction ratio per operator was 0.09 in the primary, and 0.07 in the permanent dentition. The mean level of stress was 4.9 (SD=1.9). The majority of operators regarded patients' high dental anxiety as the main reason for stress, followed by high patient load. The mean stress level increased with an increase in number of patients treated per day ($r=0.44$; $p=0.004$) and with an increase in the number of tooth extractions performed per day ($r=0.41$; $p=0.008$). Restorative dental care in this public oral health service is limited; tooth extraction is the predominant treatment provided. Operators said that high patient loads and high patient levels of dental anxiety determined this situation. To address the prevailing situation adequately, the health authority would need to introduce appropriate solutions.

Introduction

The South African Department of Health conducted a national oral health survey in 1988/89. It covered only urban areas in the country's nine provinces. The authors observed, amongst others, the need for restorative treatment in the ratio of two restorations to one extraction (1). Ten years later a report showed that restorative care in the public oral health services was provided in a ratio of only one restoration to nine extractions (2).

Using the 2001-census data, the dental operator to person ratio in South Africa was found to have been in the order of 1 to 95 727, in 2001 (3). Each dental operator in the public oral health services rendered, on average, 4 400 oral treatment procedures per year (2). These services were provided in 490 full-time and 322 part-time operating dental surgeries. An additional 131 surgeries were not utilized, owing to the unavailability of dental operators. Gugushe (2) reported that 75% of full-time operating surgeries were situated in urban, and only 25% in rural areas, and that 55% of part-time operating surgeries were situated in urban, and 45% in rural areas. Of the unutilised surgeries, 66% were situated in urban areas and 34% in rural areas. These data show the difficulties that the oral health authorities face in rendering oral healthcare to South Africans.

Conceptually, the public oral health services have been described as palliative, demand-driven, and lacking a structured budget and functional or operational concepts (2); for example, the implementation of organized school dental programmes is mainly hindered by a lack of funds (2). The provision of public oral care is further compromised by a critical shortage of oral health personnel in urban areas and the maldistribution of appropriate personnel (4,5). It is no wonder that pain relief, provision of anti-sepsis and tooth extractions constitute the main focus of oral care delivery, with limited attention being given to restorative dental care (2). It is obvious that any attempt to increase the restorative components requires an in-depth understanding of factors that drive the current manner of rendering oral care.

This paper describes the provision of restorative care and dental operators' opinions about their perceived stress in a provincial public oral health service system.

Material and methods

Selection procedure

Ethical clearance for this study was obtained from the Ethics Committee for Research on Human Subjects (medical) of the University of the Witwatersrand, Johannesburg, South Africa, under protocol number M00/07/13. The study was carried out in Gauteng Province, situated in the North-East of the country. This province consists of 5 administrative regions. In 2001 the public oral health services employed 68 dentists and 22 dental therapists. The selection criteria for participating in the study required the given consent of the operator and given permission of the regional health authority. Two of the 5 regional health authorities did not respond to the invitation to participate in the study. In one region only a restricted number of dental operators (n=9) were given permission by the health authorities to participate. The number of dental operators in the 2 participating regions was 33, making the final total of participating dental operators 42 in number.

Evaluation

Information concerning the number of all restored and extracted teeth per dentition was collected, per operator, from the dental clinic records, over a 4-month period from April to August 2001. All operators were asked to complete a questionnaire (Annex 1). Questions included operators' opinion about the number of patients treated daily, their levels of occupational stress and operators' opinions about main causes of stress. Stress levels were rated on a scale ranging from 1 = 'no stress' to 10 = 'intense stress', as suggested by Brand and Chalmers (6).

Statistical analysis

Data were entered in a data file. SPSS-12 software was used by an oral biostatistician (MvtH) to analyse the data. Statistical significance was set at $\alpha=0.05$. The mean restoration-extraction scores were calculated. Pearson's correlation test was used to correlate treatment data with daily patient loads. Spearman's rank correlation test was used to correlate perceived stress levels with daily patient loads.

Results

One operator did not complete the parts of the questionnaire covering background information and the perceived level of stress. Background information regarding the participating dental operators is shown in Table 1. Forty-two percent of the operators were female. Treatment data were collected from all 42 operators. During the 4-month period a total of 88 705 patients were treated by all operators combined. The mean number of patients treated daily per operator was 26 (SD=8.4). Treatment included scaling and polishing, minor surgical procedures, root extractions, applications of fissure sealant, topical fluoride applications, tooth extractions and restorations. Operators extracted 39 242 teeth and placed 2 992 restorations in both primary and permanent teeth. Using these data, each operator would render, on average, a combination of 3 016 restorations and extractions per year. More units of treatment were performed in permanent, than primary dentitions. Tooth extraction was by far the main type of treatment provided, whereas “white” restoration was the predominantly rendered restorative treatment. The restoration-extraction (REX) score was 0.09 in primary, and 0.07 in permanent teeth. The mean level of stress reported was 4.9 (SD=1.9). The majority of operators regarded patients’ dental anxiety as the main reason for their own perceived stress levels, followed by patient load, inadequate dental facilities and insufficient dental assistance (Table 3). The mean level of stress increased with an increase in number of patients treated per day ($r=0.44$; $p=0.004$) and also with an increase in the number of tooth extractions performed per day ($r=0.41$; $p=0.008$). There was a statistically significant correlation between the number of patients treated per day and the number of tooth extractions performed per day ($r=0.60$; $p=0.0001$).

No gender or regional effect was observed for the dependent variables under study ($p>0.05$).

Table 1: Background information on dental operators (n = 41).

	Mean	P_{10}	P_{50}	P_{90}
Age (in years)	37.7	25	39	50
Patient load (number/day)	26.4	19	25	40
Years since graduation	12.1	1	12	24
Years in current post	6.9	0	4	12

Table 2: Number of restorations and extractions rendered by provincial dental operators (n = 42) in primary and permanent dentitions during a 4-month period.

Rendered treatment	Primary Dentition			Permanent Dentition		
	N	Mean	SD	N	mean	SD
Extractions	7 019	167	117	32 223	767	117
'White' restorations	542	13	33.4	1 437	34.2	44
Amalgam restorations	72	1.7	7.4	941	22.4	32.6

Table 3: Operators' opinions (n = 41) on factors determining their perceived levels of stress whilst working in the public oral health service

Main identified reasons for stress	Dental operators (N)	%
High patient anxiety	23	56.1
High patient load	11	26.8
Inadequate dental facilities	3	7.3
Insufficient dental assistance	2	4.9
No response	2	4.9

Discussion

Why the regional health authorities did not respond to the request for participation in the study is unclear. They were contacted by telephone but even this did not evoke a response. The outcomes of the present study are, therefore, not representative for Gauteng Province.

The conditions that hinder implementation of structured restorative oral care in South Africa appear to be comparable to those reported for other developing countries (7-9). A general lack of resources seems to be a reason for the insufficient number of dental operators in the services and for not adjusting the services into an oral care delivery system that responds adequately to treatment needs and demands as advocated by Songpaisan (10). The current situation at the provincial public oral health service results in a high daily patient load, with the main focus on relief of pain. This factor, together with the operators' perceptions of high levels of patients' dental anxiety, contributed to the perceived stress experienced amongst the group of dental personnel interviewed in the present study. This finding is in line with the main sources of operator stress reported in the literature (11).

The observed low number of restorations in the public oral health service calls for action from the health administration authorities at the highest level. More emphasis should be placed on oral health education and promotion at local and national levels, using all available means of mass media. Concepts like the Basic Package of Oral Care (BPOC), that emphasises oral hygiene and fluoride deposition through cleaning teeth with affordable fluoridated toothpaste, should be vigorously advocated. Only through proper implementation of caries prevention and oral health promotion activities may the dental operator be enabled to free time for restoration of tooth cavities and thus, to prolong tooth life and increase the quality of life of the patient. The restorative care could be rendered through the ART approach, which is also a component of the BPOC.

It is concluded that restorative dental care in public oral health services of Gauteng Province in South Africa is limited and that extraction is the predominant treatment provided. Under these prevailing circumstances, premature tooth loss is high and the goals originally set by the Department of Health can, therefore, not be met (1,12). Dental operators have to work under

fairly high levels of stress that they perceive to be aggravated by a high daily patient load and patients' levels of dental anxiety. Appropriate solutions are needed in order to address the prevailing situation.

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CHAPTER 4

The effect of an Atraumatic Restorative Treatment (ART) training course on the restorative treatment pattern in Gauteng Province, South Africa

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Mickenautsch S, Frencken JE, van't Hof MA. The effect of an Atraumatic Restorative Treatment (ART) training course on the restorative treatment pattern in Gauteng Province, South Africa. Afr J Oral Health 2007; in print.

Abstract

The objective of this study was to evaluate the effect of one ART training course on the restorative treatment pattern of dental operators. The test group (N = 21) was trained in ART. The control group consisted of 20 operators. Data about the number of restored and extracted teeth and restoration type per dentition were collected 4 months before and 12 months after the ART training. The difference in restorations-extractions (REX) ratio between both groups after and before training was compared. In primary the dentition the mean increase in the REX ratio was 0.06 (SD = 0.17) (test group) and 0.03 (SD = 0.34)(control group). In permanent dentition the mean increase was 0.03 (SD=0.16) (test group) and 0.01 (SD = 0.09) (control group). The percentages of ART restorations of the total number of restorations placed in primary and permanent teeth were 67% and 11%, respectively. One 3-day ART training course did not change the overall restorative treatment pattern of dental operators but led, for the majority of operators, to a shift in caries treatment in primary teeth; from predominantly traditional, to ART restoration.

Introduction

The percentage of restorative care needs unmet amongst South Africans is very high: 96% for 6-year olds and 89% for 12-year-old children. In the 35 - 44-year-old age group, it was found to be 73% (1). Untreated carious lesions result in a reduced quality of life expressed through discomfort, pain and disfigurement, as well as acute and chronic infections (2). It has been shown that 70% of schoolchildren aged 8-10, in the Western Cape Province of South Africa, not only suffered daily toothache but also missed school education as a result (3). National figures show that 38% of 35 - 44-year olds have dental pain, 81% of which is attributed to untreated carious lesions (4).

In South Africa 80% of the population relies on public oral health services (5). In 1996 free dental care in state hospitals and clinics was introduced, which resulted in an increase of attendees, predominantly requesting pain and sepsis treatment, but rarely restorative care (6).

The Department of Health has developed a number of strategic oral health objectives. One concerns reduction of the incidence of premature tooth loss, particularly amongst South Africans who cannot afford private dental care (7). A way to achieve this objective was perceived to be through adopting and implementing the Atraumatic Restorative Treatment (ART) approach within the provincial oral health services (8,9). ART uses only hand instruments for managing cavitated caries lesions and using glass ionomers, seals caries-prone pits and fissures (13). It was selected because an increase in restorative care in both types of dentition had been reported one year after the ART approach was introduced into a mobile dental service (MDS) in peri-urban Johannesburg (11). The increase was ascribed to the less threatening nature of ART because, in contrast to conventional treatment, the need for administration of local anaesthesia is reduced and drilling teeth and suctioning saliva is unnecessary (12-14). In the meantime, research after 3 years has shown that the survival of single-surface ART restorations is comparable with that of amalgam restorations in permanent teeth (15). However, results of longer-term survival studies are conflicting. Whilst Mandari *et al*. (16) observed no significant difference between ART and amalgam restorations in single-surfaces in permanent teeth after 6 years, Frencken *et al*. (17) reported statistically significant higher survival results for single-surface ART

restorations than for comparable amalgam restorations in permanent teeth after 6.3 years.

Since 1997, dental schools in South Africa have gradually introduced it into undergraduate training but have not offered post-graduate courses in ART (18). If premature tooth loss is to be reduced through ART, the public service dental workforce has to be trained in its use. Interventions such as participative workshops, follow-ups and feedback audits are known to be effective (19). However, owing to limited resources and organisational constraints, a single participative workshop appeared to be the most practical option for introducing ART into the South African public oral health service. The present study was aimed at evaluating, after 12 months, the effect of a single ART training course on the treatment pattern of dental operators in a regional public oral health service.

Material and methods

Study design

Permission to carry out the present study was obtained from the Ethics Committee for Research on Human Subjects (Medical) of the University of the Witwatersrand, Johannesburg, South Africa, under protocol number M00/07/13. The study was carried out in Gauteng Province, South Africa. In 2002 the public oral health services employed 68 dentists and 22 dental therapists. While regional health authorities of all the 5 administrative regions of the province were invited to participate in the study, 2 did not respond.

The test group consisted of all 18 dentists and 3 dental therapists employed in the public oral health service of the Ekurhuleni region, situated east of Johannesburg. Fifteen operators were South Africans, while the remaining 6 came from Chile, DR Congo, UK, Nigeria and Rumania. The control group consisted of all 8 dentists and 4 dental therapists employed in the public oral health service from the nearby Sedibeng region (n=12), south of Johannesburg, and 8 dentists from the Central Witwatersrand region. The latter were selected for logistical reasons based on the close proximity of their clinics to the location of the investigator. Of the control group operators, 15 originated from South Africa; the other 5, from India, Nigeria and Rumania. These operators neither received ART training nor applied ART in the clinics.

Intervention

Operators in the test group were trained in ART according to recommended course standards (20) by a staff member (SM) of the Division of Public Oral Health, University of the Witwatersrand, Johannesburg, in August 2001. The training was conducted during a 3-day workshop. Lectures at the Dental School on the first day were followed, on days 2 and 3, by clinical training on selected patients at a primary healthcare clinic in an informal settlement south of Johannesburg. Lectures contained information on (dis)-advantages of ART, its clinical indication, successes and failures of ART restorations and sealants, selection of materials and instruments, hand-mixing of glass ionomer, clinical procedures and management of failed restorations. Operators received copies of the lectures and the ART manual (22). Contrary to recommendation, no pre-clinical training in the use of ART on extracted teeth was given. Clinical training consisted of demonstration of the use of ART by the trainer, followed by supervised ART treatment of carious lesions by operators. A workshop was attended by groups of 4-6 participants operating in pairs: one carried out the treatment while the other provided chair-side assistance. The functions were alternated for the treatment of successive patients. Each operator restored between 3 and 10 cavities in the 6 -15-year-old children selected.

Evaluation

Information concerning the number of restored and extracted teeth and type of restoration per dentition was collected from dental clinic records over the 4 months preceding the ART training (April to July 2001) and over 12 months after its completion (August 2001 to July 2002). The same type of information regarding the control group was collected during two similar periods: May to August 2002 and September 2002 to August 2003. The dental operators did the recording. The dental records formed the basis for calculating the ratio of number of restorations to number of extractions (REX score). The magnitude of the REX score expresses the effect of the ART workshop on the treatment pattern in both groups over a period of 12 months. In addition, the proportion of ART restorations to the total number of restorations placed in the test group was calculated separately for primary and permanent dentitions.

Statistical analysis

In this retrospective cohort study, with the operator as the unit of investigation, the difference in REX scores between the test and control group before and after ART training was calculated, using the Mann-Whitney U test. The dependent variable was the difference in restoration/extraction ratio (Δ REX score) pre- and post-ART training. An oral biostatistician (MvtH) did the statistical analysis, using SPSS-12. Statistical significance was set at α=0.05.

Results

The gender ratio (M/F) in the test group was 9/12, and 14/6 in the control group. The mean age of operators in the test group was 38.2 ± 8.9 years, and 36.3 ±10.0 years in the control group. In the test group, operators had graduated on average 11.5 ± 8.1 years previously and worked in their current position for, on average, 4.3 ± 4.4 years. In the control group, operators had graduated, on average, 10.68 ± 10.1 years before from dental school and worked in their current positions for an average of 5.9 ± 8.8 years. The main type of treatment provided in both study groups was tooth extraction (Table 1).

The REX scores before and after ART training, by type of dentition and by group, are shown in Figure 1. The differences in mean REX scores between the test and control group, for both dentitions, were not statistically significant. In primary dentition, the mean increase in the REX score in the control group was 0.03 (SD = 0.34); in the test group, 0.06 (SD = 0.17). In permanent dentition, the mean increase in the REX score in the control group was 0.01 (SD = 0.09); in the test group, 0.03 (SD=0.16).

The percentages of ART restorations, of the total number of restorations done in primary and permanent teeth, were 67% and 11% respectively, over the 12-month period post-ART training (Table 1). In the test group, 15/21 operators restored more than 50% of the cavities in primary teeth, using ART. In the permanent dentition only 2/21 operators mainly used ART to restore cavities. The two highest Δ REX scores (0.70 and 0.22) in the primary dentition were observed by operators who did predominantly ART restorations and who did many (more than 100) ART restorations during the 12-month observation period, whereas the highest Δ REX score (0.63) in the

permanent dentition was observed by the operator who did predominantly traditional restoration during the 12-month observation period (Table 2). Neither country of origin, gender nor type of operator affected the number of ART restorations done.

Table 1: Number of extracted and restored primary and permanent teeth per month by test and control group over a 4-month period before, and a 12-month period after, ART training. N=number of operators

			Test group (N=21)	Control group (N=20)
Primary teeth				
Extracted	Before		1132	622
	After		842	538
Restored (total)	Before	N	67	86
		REX	0.06	0.14
	After	N	98	93
		REX	0.12	0.17
ART restorations (% of total restorations)	After		65(67%)	-
Permanent teeth				
Extracted	Before		4711	3345
	After		3642	3251
Restored (total)	Before	N	387	208
		REX	0.08	0.06
	After	N	406	216
		REX	0.11	0.07
ART restorations (% of total restorations)	After		46(11%)	-

Table 2: Percentage of ART restorations of total number of restoration and Δ REX score for the test group by type of dentition between a 4 month period 'before' and a 12 month period 'after' ART training.

Dental operator	Primary dentition		Permanent Dentition		Combined Dentitions	
	ART restorations (%) of total restorations	Δ REX score	ART restorations (%) of total restorations	Δ REX score	ART restorations (%) of total restorations	Δ REX score
> 100 ART restorations placed post training period						
1	97%	+0.70	49%	-0.02	83%	+0.29
2	88%	+0.22	2%	-0.05	35%	0
3	84%	+0.04	74%	+0.09	75%	+0.08
50-99 ART restorations placed post training period						
4	98%	+0.09	23%	-0.01	50%	+0.01
5	81%	+0.04	24%	0	46%	+0.01
6	77%	+0.02	8%	-0.01	16%	0
7	63%	+0.07	4%	+0.01	21%	+0.02
8	20%	-0.08	4%	+0.63	5%	+0.50
25-49 ART restorations placed post training period						
9	96%	+0.06	21%	+0.01	48%	+0.02
10	94%	+0.04	60%	+0.01	70%	+0.01
11	62%	+0.04	4%	+0.02	11%	+0.03
12	44%	-0.2	0%	-0.08	7%	-0.10
13	37%	+0.06	27%	+0.04	30%	+0.04
14	27%	-0.06	2%	-0.11	9%	-0.09
10-24 ART restorations placed post training period						
15	100%	+0.01	6%	+0.07	8%	+0.06
16	94%	+0.01	4%	+0.03	14%	+0.02
17	85%	0	34%	0	49%	0
18	67%	+0.04	23%	0	42%	+0.01
<10 ART restorations placed post training period						
19	83%	+0.01	3%	+0.04	7%	+0.03
20	38%	+0.08	0%	0	3%	0
21	17%	+0.16	0%	-0.29	2%	-0.19

Δ REX score = difference in restoration-extraction ratio pre- and post-ART training
A positive/negative Δ REX score indicates an increase/decrease in the number of restorations over the number of extractions in the 12-month post-ART training period.

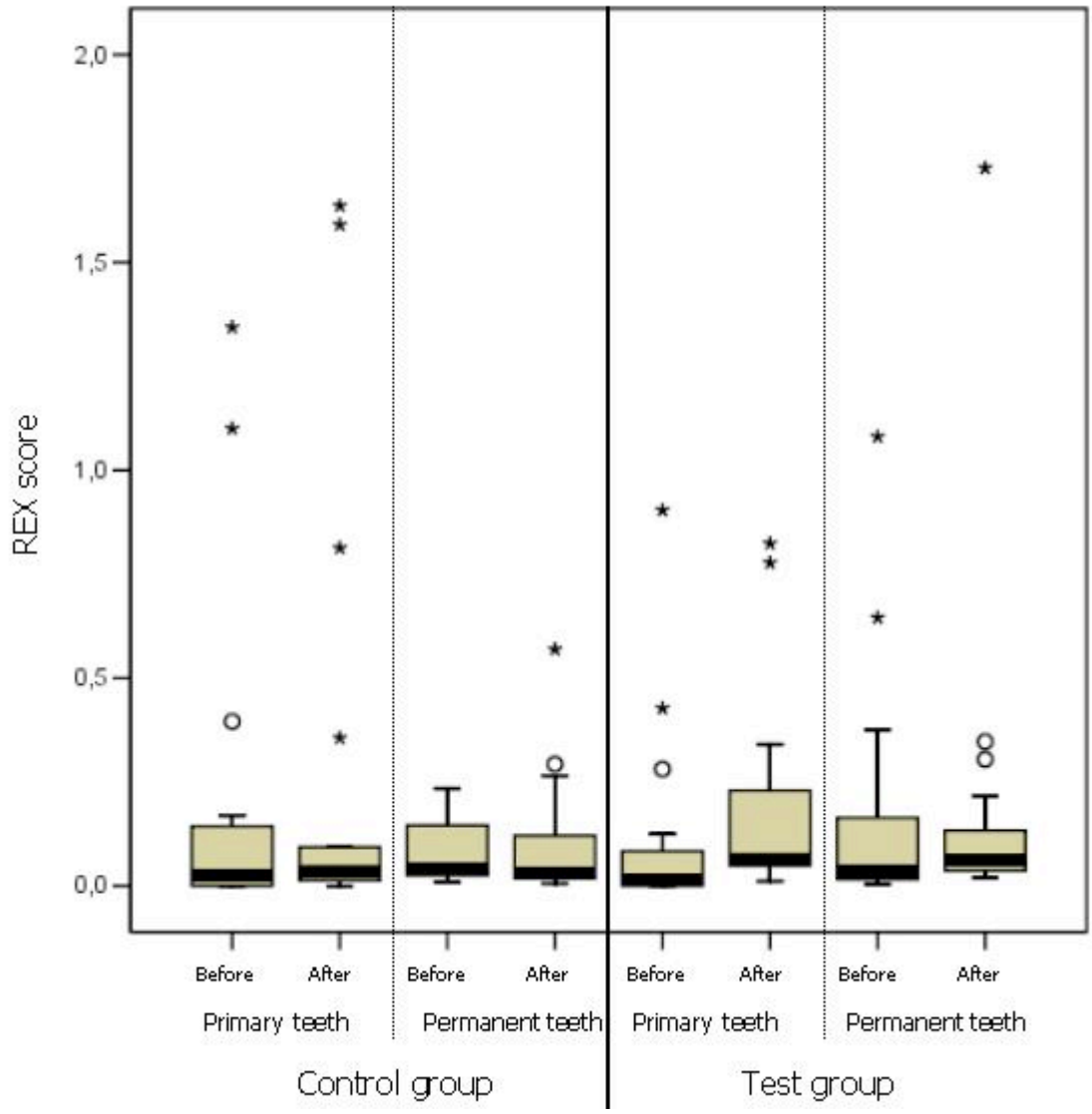

***Figure 1**: Box-Whisker plots for the REX score by treatment group (test and control) and type of dentition (primary and permanent) over a 4 months period 'before' and a 12 months period 'after' ART training. The box includes the quartiles, the bold horizontal line indicates the median and the whiskers mainly include outliers in positive direction. REX = restoration / extraction ratio*

Discussion

The present study followed, in essence, the principles of a retrospective cohort design without randomisation. Randomisation of operators within a clinic was impossible for organisational reasons. Such an observational study would have included the danger of confounding and biased information.

Information bias may be related to the included clinics, as treatment data were sometimes recorded by staff at the end of the day and not immediately after completion of the treatment. Such reliance on memory potentially creates a recall bias. Evaluator blinding was also impossible. It would have required the employment of an outside evaluator totally ignorant about the ART training, for a considerable length of time. At the time of the study no such evaluator was available. Confounder bias could have been caused by operator characteristics (e.g. such as clinical experience), clinic characteristics (e.g. location) and patient characteristics (e.g. gender). It was assumed that such influences would be reflected in the pre-ART training REX scores. Therefore, confounder correction was carried out by testing the change in REX scores pre- and post-ART training. The period during which the records were collected for the test and control groups differed by month and by year. The difference in months was small but a one-year difference in year of collection between test and control group was caused by organisational and financial factors. It is known that summer patient clinic attendance patterns may differ from winter ones (6). However, since data collection in the present study remained within the same season for the test and control groups, it is unlikely that the attendance pattern in the clinics differed over the years (community dentistry specialist South Africa - personal communication).

No difference was found in mean REX scores between test and control groups after 12 months. Therefore, operator knowledge and clinical skills in ART, obtained during a three-day training course, did not increase the overall restoration - extraction ratio in the public oral health services. The predominant treatment provided remained tooth extraction. However, secondary analyses showed that in primary teeth over the 12-month period, the ART training course had led, for the majority of operators, to a shift in restorations; from the predominantly traditional to ART. The dentist with the highest Δ REX score in primary teeth had started applying ART because the dental unit was out of order, whereas the dentist with the second highest Δ REX score in primary teeth applied ART because of its child-friendly nature.

The mean REX score in the test group in the present study is much lower than that reported for a one-year pilot study which investigated the introduction of ART in an academic mobile dental service (MDS) setting,

serving a disadvantaged, peri-urban community of Johannesburg (11). In the pilot study no traditional treatment was offered during the post-ART training period because the operators preferred the child-friendly nature of ART that does not require a drill and hardly needs the administration of an injection (12,13). The reason for the different outcomes in both studies may in part be due to different conditions under which oral healthcare was provided. Conditions like operator workload, service management, operator- and patient opinions, material supply, clinical ART skills and chair-side assistance appear to differ. The pilot study operated under academic conditions, with the aim to demonstrate new appropriate technologies and approaches for oral healthcare delivery and to investigate their efficacy. In order to meet this aim, good clinical skills, expertise and high motivation towards new healthcare approaches such as ART, were prerequisites amongst staff. The unit was well supplied and the number of patients manageable. In contrast, operators in public oral health services were requested to adopt the ART approach into their daily clinical practice after a short training course. Additional assistance was not possible, owing to limited resources and organisational constraints at provincial level. Therefore, a single participative workshop appeared to be the optimal way for training the operators in ART. However, it has been reported that single educational interventions cannot overcome potential barriers in the process of changing clinical practice (19). Such barriers may include factors related to operator perception, patients' perceptions and beliefs and factors related to the practice environment (19). The acceptability of technological innovation, such as the ART approach in the present study, may not necessarily depend on operators' previous practice experience, but more on their perceptions about the clinical advantages of the new method in relation to the current treatment procedures (22). Freeman (23) suggests that operators tend to discount patient worries and concentrate too much on clinical features. The absence of an overall effect in the restoration - extraction pattern after the introduction of ART in the present study may have been influenced by the lack of follow-up seminars and of pathways for communication about the experiences obtained with the use of ART compared to traditional treatment, among the operators of the test group. A further barrier that may not be neglected in the South African context is the

practice environment, characterised by malfunctioning equipment, insufficient human resources and a general lack of essential materials.

This study showed that one single ART training course had not changed the overall restoration-extraction pattern of dental operators in a regional public service after 12 months but it had led to a shift in the restoration pattern in primary teeth, from predominantly traditional to ART.

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CHAPTER 5

Atraumatic Restorative Treatment and dental anxiety in outpatients attending public oral health clinics in South Africa

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This chapter is a modification of the publication by Mickenautsch S, Frencken JE, van't Hof MA. Atraumatic Restorative Treatment and dental anxiety in outpatients attending public oral health clinics in South Africa. J Public Health Dent 2007; 67:179-84.

Abstract

This study was undertaken to test the hypotheses that using the Atraumatic Restorative Treatment (ART) approach results in lower patient anxiety and that lower anxiety leads to higher restoration/extraction ratios. The test group of dental operators (n = 9) was trained in ART. The control group (n =11) was not, and did not apply ART. The CFSS-SF and CORAH's DAS scales were used to assess patient anxiety after ART (test group) and after traditional restorations (control group). The restoration/extraction ratio calculated for primary (children) and permanent dentitions (adults) per operator was based on 12-month treatment statistics. Dental anxiety assessments were analysed using ANOVA. Differences were compared using the t-test and corrected for confounding factors (ANCOVA). The Pearson correlation coefficient was used to measure the correlation between dental anxiety levels and restoration/extraction ratios. The mean CFSS-SF score for test-group children was statistically significant: (p=0.001), lower (14.8: SE = 1.7) than for the control-group children (24.4: SE = 1.2). The mean DAS score for test-group adults (6.7: SE = 0.4) was statistically significant: (p=0.0005), lower than the control group's (9.3: SE= 0.2). No significant difference in the REX score was observed between the test- and the control group. The first hypothesis was accepted; the second, rejected. Although dental anxiety scores were lower both in child and in adult patients treated by ART than in those who received traditional restorative treatments, this positive effect had not resulted in higher restoration/extraction ratios.

Introduction

Public oral health services in developing countries have only limited resources and manpower with which to address their populations' oral healthcare needs and demands. In South Africa, approximately 600 dental operators (dentists, dental therapists, oral hygienists) in public service serve 60 to 80% of a population of 44.8 million people (1-3). Under such circumstances, the focus of treatment is directed to the relief of pain and sepsis through extraction, leaving little time for restoring decayed tooth surfaces and preventing progression of caries and periodontal disease.

According to the results of the National Oral Health Survey in South Africa 1988/89, treatment needs for restorable carious lesions were twice as high as those for tooth extraction (3). There is a disparity between this result and the high ratio of nine tooth extractions to one restoration rendered in the South African public service ten years later (2). It seems, therefore, very unlikely that the continuing use of the current restorative treatment regime will lead to attainment of the South African National Department of Health's goal of reducing premature tooth loss within the population, in the foreseeable future (3).

An appropriate alternative to the traditional restorative treatment approach is Atraumatic Restorative Treatment (ART). This approach relies on hand instruments for removing infected carious tooth tissues and using adhesive restorative materials to fill the cavity and adjacent pits and fissures (4). Mickenautsch *et al*, (5) introduced ART in a dental outreach service in South Africa and reported a significant increase in the number of restorations relative to the number of extractions, one year after the introduction of ART. Motivation for the operators in the cited study to use ART was the absence of the necessity to administer local anaesthesia or use the noisy drill and suction machines, all of which were perceived as potentially frightening for children (5). The absence of these characteristics of traditional restorative treatment that frighten children were thought to have been instrumental in reducing dental anxiety and increasing patients' compliance which, in turn, had increased operators' willingness to treat more painful teeth restoratively, instead of extracting them in accordance with common practice (6). If the application of ART would improve the current national low restoration to

extraction (REX) ratio of 0.11 and simultaneously reduce the level of dental anxiety among patients, the goal of reducing premature tooth loss in South Africa's public oral health services could be met.

Because of promising results from the pilot study (5), health authorities in one region of Gauteng Province in South Africa expressed the desire to introduce ART into the provincial oral health service system. The subsequent introduction of ART through a training programme was accompanied by a one-year monitoring programme (6). One aim of the monitoring process was to test the hypothesis that the ART approach causes lower dental anxiety levels in child and adult patients. The second aim was to produce higher restoration to extraction scores in a public oral health service setting through its use, after 12 months, than are achieved through using a traditional restorative treatment approach.

Materials and methods

Study design

With permission from the Ethics Committee for Research on Human Subjects (Medical) of the University of the Witwatersrand, Johannesburg, South Africa (under protocol number M00/07/13), the study was carried out in Gauteng Province, South Africa. Gauteng is the smallest province in the country (17 010 km^2), with equal levels of population density and urbanisation in all of its 5 administrative regions (Central-Witwatersrand, Ekurhuleni, Sedibeng, Pretoria and West Rand). It consists predominantly of large peri-urban areas and covers almost entirely the three metropolitan areas of Johannesburg (Central-Witwatersrand, Ekurhuleni, West Rand regions), Pretoria (Pretoria region) and Vereeniging (Sedibeng region) (1). Small stone houses supplied with electricity and piped water, a high unemployment rate and a large informal economic sector characterize the communities in peri-urban areas.

All regions of Gauteng were invited to participate in the study but the health authorities in Pretoria and West Rand did not respond. All dentists and dental therapists employed full-time from the Ekurhuleni region (n = 21), whose health authorities wanted ART to be introduced into the oral health services, were trained in ART in 2001. The training followed a standard training course of 3 days (7). The test group consisted of 9 of the original 21

dental operators trained in ART, whereas the control group comprised dental operators from the nearby Sedibeng region, south of Johannesburg (n =11). The dental operators of the control group had not received any ART training, nor had they applied ART in their daily practice.

Assessment of dental anxiety

The inclusion criteria for the test group were patients who had received an ART restoration. Patients who had been treated restoratively with the traditional approach on the day when the fieldworker visited the clinic of the dental operator, constituted the control group. The fieldworker asked patients to complete questionnaires outside the clinic immediately after they had been treated. Those unable to read and understand the questionnaire were interviewed by the fieldworker. Each dental operator was visited once a month over the 12-month evaluation period.

The Children's Fear Survey Schedule (CFSS-SF) questionnaire was used for children up to the age of 15 years (Annex 4). This is a shortened form of the Children's Fear Survey Schedule – Dental Subscale (CFSS-DF). The CFSS-DF contains 15 items, on a scale of 1 to 5, that are related to: 1) invasive dental procedures 2) less invasive dental procedures and 3) general medical aspects of treatment (8). The CFSS-SF is restricted to only the 8 items related to invasive dental procedures. Each has a possible score rating of 1 (no fear) to 5 (very frightened). The total minimum score is 8; the total maximum score is 40 (9).

The Corah's Dental Anxiety Scale (DAS), consisting of 4 items and developed for assessing dental fear and anxiety in adult patients, was used for patients 16 years and older (Annex 5) (10). As in the CFSS-SF, each DAS item ranged from score 1 to 5, with a total minimum score of 5 and a total maximum score of 20. Both scales were applied to patients having received ART restorations in the test group and to those having received traditional restorations in the control group.

Evaluation

In the test group, information concerning the backgrounds of the dental operators, the number of restored and extracted teeth and the type of restoration per dentition was collected from dental clinic records over a 12-month period following completion of the ART training (August 2001 to July 2002). Information on the same variables was collected in the control group during the 12-month period of September 2002 to August 2003. Recording was done by the dental operators and collected by the fieldworker.

Statistical analysis

An oral biostatistician (MvtH) performed the analysis, using SPSS-12. The quality of the data was checked by calculating Cronbach's alpha for both dental anxiety scales. Cronbach's alpha for the CFSS-SF and DAS scales was 0.94 and 0.88, respectively, indicating a high reliability level in the data obtained.

The dependent variables were the mean CFSS-SF and DAS scores. The independent variables used were: test and control group, gender, age and number of teeth restored. Data were analysed using ANOVA and ANCOVA, and the t-test was used in testing differences in results. A difference was statistically significant at $\alpha = 0.05$. Based on clinic record statistics, the restoration/extraction (REX) ratio over the 12-month period, in primary dentitions and in permanent dentitions of patients 16 years and older, was calculated. Children who had received a restoration in permanent dentition were excluded from the analyses. The Pearson correlation coefficient was used for measuring correlations between mean CFSS-SF scores, mean DAS scores, and mean REX scores for primary and permanent dentitions by operators.

Results

Disposition of subjects and operators

The test group consisted of 9 and the control group, of 11 dental operators. Background information about these dental operators over the 12-month observation period is presented in Table 1. Background information about the patients interviewed in the test and control group over the same period is

presented in Table 2. Children interviewed in the test group were younger than those in the control group ($p < 0.01$). Adult patients of 5 of the 9 dental operators in the test group were interviewed. Consequently, many more restorations were observed in the control (218) than the test (38) group. All operators in the test group had placed ART restorations in children and all in the control group had placed conventional restorations in adults and adolescents.

Table 1: Background information of dental operators per treatment group: SD = Standard Deviation

	Test group		Control group	
	Mean	SD	Mean	SD
Age (in years)	41.0	8.7	36.3	7.1
Number of patients treated per day	24.2	8.5	26.2	8.5
Years since graduation	14.6	7.6	11.3	8.2
Years in current post	5.8	3.7	4.1	2.4

Table 2: Background information about patients treated and interviewed by treatment and age group over a 12-month period. SD = Standard Deviation

		Test group		Control group	
		Children	Adults	Children	Adults
Number of patients treated and interviewed		59	38	84	218
Gender ratio (M/F) of patients		27/32	10/28	36/48	94/124
Age (years) of patients	Mean	8.9	27.3	10.3	31.1
	SD	3.0	8.2	3.0	8.9
Number of restorations placed per patient	Mean	1.5	1.5	1.5	1.4
	SD	0.6	0.7	0.7	0.6

REX score

The mean REX score of dental operators, in child patients, was 0.10 (SD = 0.11) in the test group, and 0.04 (SD = 0.03) in the control group (p=0.15). The mean REX score of dental operators, in adult patients, was 0.04 (SD = 0.03) and 0.04 (SD = 0.04) in test and control groups, respectively.

Dental anxiety levels

The mean DFSS-SF score for the test group children was lower (14.8: SE = 1.7) than that for the control group children (24.4: SE = 1.2). The difference was statistically significant (p = 0.001). The treatment effect on dental anxiety in children was estimated to be 9.8 anxiety points (95% CI = 5.0-14.6) after correction for the child variables (ANCOVA with age, gender and number of restored teeth). The mean DAS score for adults from the test group (6.7: SE = 0.4) was statistically significant (p=0.001); lower than that for adults from the control group (9.3: SE = 0.2). No confounding effects were observed in the analyses of the DAS data (ANOVA). The treatment effect on dental anxiety for adults was estimated to be 2.6 anxiety points (95% CI = 2.0-3.0).

No significant correlations were observed between mean DFSS-SF scores and mean REX scores of the operators, regarding primary teeth of child patients (r = -0.65; p = 0.06), or between mean DAS scores and mean REX scores of the operators treating adult patients (r = 0.03, p = 0.97) in the test group. The results were similar for child patients (r = 0.08, p = 0.81) and adult patients (r = -0.24, p =0.49) in the control group (Figures 1, 2).

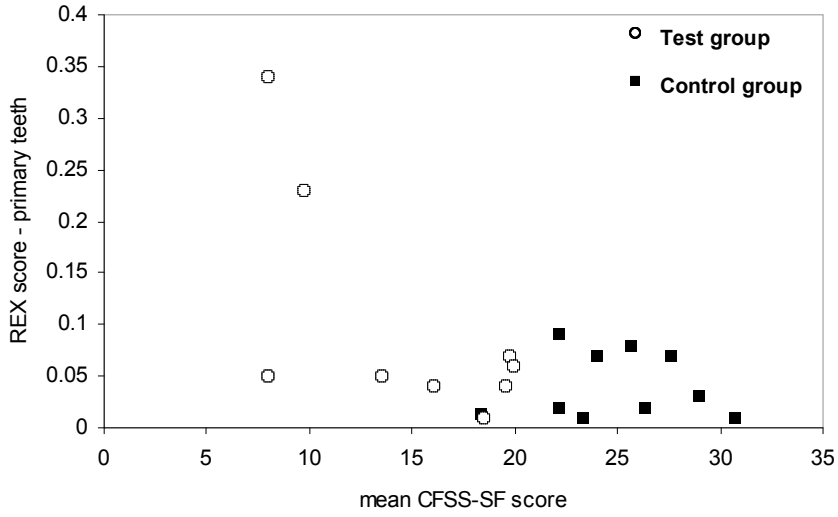

Figure 1: *Relationship between mean dental anxiety (CFSS-SF) and restoration/extraction (REX) score for child patients in primary teeth per operator for test (ART) and control (traditional) group*

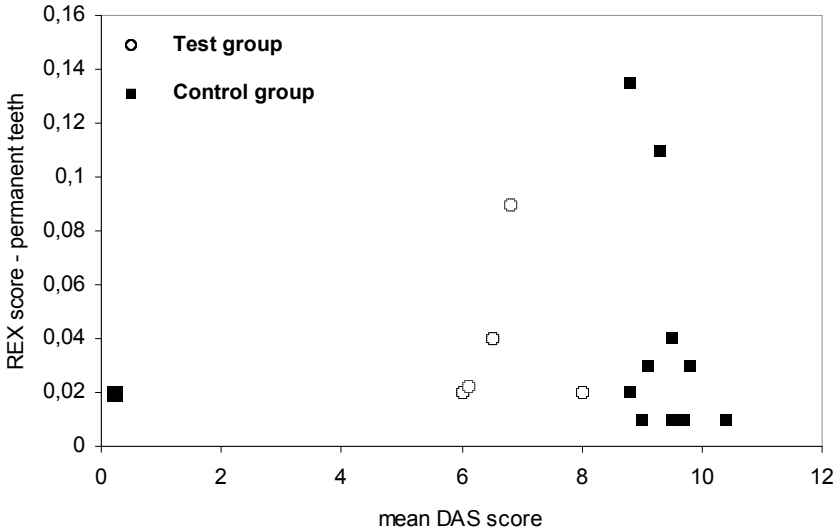

Figure 2: *Relationship between mean dental anxiety (DAS) score and restoration/extraction (REX) score for adult patients per operator from test (ART) and control (traditional) group*

Discussion

This is the first study in which effects of the introduction of the ART approach through special ART training of dentists and dental therapists have been measured in a public oral health service system. A field study of this nature has the advantage that the test is carried out under real-life conditions. A disadvantage is that standard scientific requirements cannot always be fulfilled. Ideally, patients should have been randomised for ART and for traditional restorations, to avoid bias in the relationship between type of treatment and dental anxiety levels, but this was not feasible in the present field situation. An alternative to deal with the lack of randomisation would have been to carry out a pre-treatment assessment of the level of dental anxiety for those who received ART and those who were traditionally treated for a restoration. However, this turned out to be difficult to implement. Patients do not visit the dental outpatient clinic on appointment. They simply arrive, most complaining of toothache. Therefore, it is not possible to know if a patient will receive a restoration at the time (s)he enters the treatment room. Furthermore, only a few patients had received restorative care during an earlier visit. Most had to be convinced that a restoration rather than an extraction would be the best treatment to deal with their complaints.

The assessment of dental anxiety by a single questionnaire could only measure patients' perceptions about the treatment provided on a single occasion. Because the results on patients' anxiety are cross-sectional, only correlations with the different treatment approaches can be shown but no causation could be established (11,12).

The calculation of the REX score relied on data collected in periods, which differed for test and control group by month and by year. This difference was caused by organisational and financial factors. However, since data collection remained within the same season for both groups, there is no reason to believe that the attendance pattern had differed (community dentistry specialist South Africa – personal communication).

The selection of dental operators in the test group was done to allow the field worker, who relied mainly on public transport, to visit one dental clinic per day. However, some dental clinics in the test group were situated so far from her base that she could not reach them in a day. That necessitated the

exclusion of operators working in clinics too distant from the study base. As there were no major differences between the clinics constituting the test group, in terms of provision of treatment, availability of equipment and costing of services, the selection was not considered to have caused an unacceptable bias in the study design. Initially, Sedibeng and Central-Witwatersrand were selected to constitute the control group. For the same logistic reasons that determined the collection of data in the test group, only dentists in the Sedibeng region could be visited as the field worker lived in the region.

The number of patients interviewed over the 12-month period was low. This observation reflected the present restorative treatment pattern in clinics in the public oral health service in the study areas and elsewhere in South Africa (6) The availability of only one fieldworker, who could only visit a clinic once a month, may have further limited the number of patients interviewed. Usually the fieldworker had to spend a whole day waiting to interview only a few patients who had received restorative care. Occasionally, absolutely no restorative treatment was rendered on her visiting day. This explains why adult patients of only 5 of the 9 operators in the test group were interviewed.

Corah's dental anxiety scale (DAS) was adopted for this study because it has frequently been used to assess dental anxiety of adults and has shown good reliability (13-16). As the DAS scale is useful only for children with the cognitive ability to understand its questions (17,18), because it omits questions about treatment procedures like "cleaning the teeth", that may cause distress for children but not for adults (18), and as there is insufficient evidence of its reliability in relation to children (10), in this study the DAS scale was not used for children under 16 years of age.

The Child Fear Survey Schedule (CFSS-DF) has been demonstrated to be highly reliable (Cronbach's alpha 0.62–0.92) for measuring dental anxiety in children, particularly in relation to invasive dental procedures (8-10). Traditional restorative treatment included invasive procedures such as the administration of local anaesthesia and drilling of teeth. Hence, the CFSS-DF appears to be an ideal measurement instrument for assessing differences in dental anxiety about both treatment types. However, the CFSS-SF scale, being a modification to the CFSS-DF scale, was chosen as the measurement instrument for dental anxiety in children because it was shorter and had high

reported reliability (9,19). It has been shown that shorter rating questionnaires are generally more acceptable to children (20) and that the CFSS-SF can successfully be applied, particularly in the African situation (9).

The results of this study showed that both child and adult patients treated with the ART approach were less dental-anxious than those whose treatment used the traditional approach. The first hypothesis was accepted. This result is in accord with findings of other studies comparing patient anxiety and discomfort levels in children undergoing ART restorative treatment with those experiencing traditional approaches (21-23). There appears to be no other comparative study on dental anxiety in adults treated with the ART and traditional restorative treatments.

Negative patient attitudes towards dentists and uncooperative behaviour are generated by patients' fear of experiencing pain or discomfort during dental treatment (24-31). It can be assumed that reduced patient anxiety and discomfort may, therefore, lead to more positive behaviour which, in turn, may reduce operator stress during interaction with patients (32-36). Such a positive effect could motivate operators to choose ART above traditional restorative treatment options and resort to providing restorative care more frequently than at present. This study confirmed the expectation that the mean CFSS-SF score for children in the test group was statistically significantly lower than for children in the control group. A significant correlation between reduced dental anxiety in children and adults and increased REX scores of dental operators was not found. There was no difference in the mean REX score between the test- and control groups**.** Therefore, the second hypothesis was rejected. Among reasons for the rejection may be the influence of factors such as patient load, supply of materials, clinic environment and lack of chair-side assistance, which may have hindered full implementation of the ART approach. These factors may also have contributed to the fact that the REX score for adult patients after ART introduction (0.04) was below the national average of 0.11 (without ART). These factors constitute barriers to successful ART implementation and need to be investigated. It is also possible that the 12-month evaluation period was too short to show a possible effect. Attempts are being made to undertake a long-term evaluation in the near future.

In conclusion; although dental anxiety scores were lower in patients treated by ART than in those treated by traditional restorative means, this in itself had not led to an increase in the restoration to extraction ratio in primary dentitions of children and permanent dentitions of adults, in provincial public oral health clinics in South Africa.

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CHAPTER 6

Factors inhibiting the implementation of the Atraumatic Restorative Treatment approach in public oral health services in Gauteng Province, South Africa

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This chapter is a modification of the publication by Mickenautsch S, Frencken JE, van't Hof MA. Factors inhibiting the implementation of the Atraumatic Restorative Treatment approach in public oral health services in Gauteng Province, South Africa. J Appl Oral Sci 2007; 15:1-8.

Abstract

Objective: To investigate potential barriers to the utilisation of the ART approach in a South African public oral health service. Method: 7 barriers were identified: *patient load/work load, operator opinion, patient opinion, service management, material supply, clinical ART skill, chair-side assistance*. Operators were asked to answer a questionnaire one year after completing the ART training. Responses ranged from 1 = no barrier to 5 = highest barrier. Treatment data per operator were collected during 1 year after training, for both dentitions, including: number of extracted teeth, placed traditional restorations, ART restorations. The restoration/extraction (REX) ratio and the proportion of ART restorations (ART%) of the total number of restorations were calculated and correlated with the barrier variables. Pearson correlation, ANOVA and 2-tailed t-tests were used in the statistical analyses. Results: *Patient load/work load* (mean = 2.80: SE = 0.16) was the strongest barrier ($p<0.001$) and *clinical ART skill* was the weakest barrier ($p<0.001$). A significant correlation between *material supply* and mean REX score was observed in both dentitions. In primary teeth, the ART% correlated significantly with *clinical ART skill* ($r= -0.63$; $p<0.01$). In permanent teeth, statistically significant correlations were observed between ART% and *patient load/work load* ($r = -0.54$; $p<0.05$), *patient opinion* ($r = -0.76$; $p<0.01$), *operator opinion* ($r = -0.53$; $p<0.05$), *chair-side assistance* ($r = -0.57$; $p<0.05$), *oral health service management* ($r = -0.46$; $p<0.05$). Conclusion: 1 year after ART training completion an insufficient supply of dental materials had inhibited the provision of restorative care in relation to tooth extractions for both adult and child patients.

Dentists' perceptions of low levels of clinical skills in performing ART confidently after training was a barrier to utilising ART in children and high patient load/work load, negative operator and patient opinion, insufficient chair-side assistance, and poor management of services by health authorities were factors that inhibited the proper utilisation of ART among adults in the public oral health service of the Ekurhuleni region 12-months post-ART training.

Introduction

Atraumatic Restorative Treatment (ART) is based on the removal of soft denaturated carious tooth tissue, using hand instruments only. In most cases the cleaned cavity is then conditioned and restored with a high-viscosity glass ionomer cement (1). The ART approach evolved in response to the unavailability of restorative care in population groups with limited resources (2). Owing to its independence from electricity and expensive dental equipment, ART appears to offer a pragmatic solution to the problems related to restoring tooth cavities and sealing caries-prone tooth surfaces, faced by oral health workers in developing countries (3-6). Makoni et al. (1997) showed that ART could be applied in 84% of dental lesions in a population with a caries prevalence of 41% and a mean DMFT score of 1.1 (7). Based on a meta-analysis, Frencken *et al*. (2004) reported that no difference existed between survival results of single-surface ART restorations and comparable amalgam restorations in the permanent dentition after 3 years (8). Recently, the survival percentage after 6.3 years, of ART restorations using glass ionomer, was reported to be higher than that of comparable restorations placed through the traditional approach using amalgam (9).

ART was officially adopted by the World Health Organisation (WHO) in 1994 as a suitable caries-controlling approach for use in primary oral healthcare programmes in developing countries (10). Reports from developing countries such as South Africa, The Gambia and Uganda have recommended the use of ART for addressing the need and demand for preventive and restorative care in their countries (11-13).

As in other developing countries, the public oral health service in South Africa is characterised by limited financial resources, a resulting critical shortage of oral health personnel and facilities inadequate to cope with the increasing level of oral disease and demand for treatment (14). In South Africa only 11% of all dentists work in the public dental service, mostly in urban centres (15), whereas 80% of the population relies on the public health services for oral care and only 73% live in urban areas (16-18). The shortage of oral health personnel, inaccessibility of oral health services and low priority of oral health amongst members of the communities have been identified as barriers to obtaining oral care (14). The low priority given to oral health by

many people is considered to be related to prevailing ignorance about disease prevention. As a result of this, many patients use dental services mainly for symptomatic reasons, such as toothache (15), seeking tooth extraction rather than restoration to treat painful cavitated dental lesion (19).

In line with the endorsement and recommendation from WHO (10), ART was introduced into South African public oral health services in 1998, in an attempt to improve the oral health services through changing the caries treatment pattern from predominantly extracting, to restoring teeth. A study was set up in 2001, in which 21 dentists working in the regional public service of Ekurhuleni, Gauteng Province, were trained in ART during a 3-day course. Evaluation after one year showed that each of these dentists had placed, on average, 5 ART restorations per month, compared to an average of 19 traditional restorations. This finding was unexpected. The expectation had been that a higher number of ART restorations would result after dentists had attended a training course in ART. Furthermore, the evaluation showed that where dental equipment was available and functioning, dentists preferred to use traditional restorative treatment methods instead of the ART approach.

Despite its merits as appropriate for use in developing countries, successful implementation of the ART approach in the public oral health services after dentists had attended an ART course appeared to have been hindered. This study was undertaken to report on factors that may have inhibited the utilisation of ART in a South African regional public oral health service system.

Materials and methods

Ethical clearance for the main study was obtained from the Ethics Committee for Research on Human Subjects (Medical) of the University of the Witwatersrand, Johannesburg, South Africa under protocol number M00/07/13.

All 21 dental operators employed full-time in the Ekurhuleni region in Gauteng Province had been trained in ART in 2001. The training followed recommended course standards (20) and was conducted by a staff member (SM) of the Division of Public Oral Health, University of the Witwatersrand, Johannesburg.

Description of identified barriers

Seven factors related to the provision of service were identified as possibly exercising an inhibitory influence (barrier effect) on the utilisation of ART by dental operators in public health services in South Africa (21). These were: patient load / work load, operator opinion, patient opinion, oral health service management, material supply, clinical ART skill, chair-side assistance.

- *1. Patient load / work load* - Extraction as a useful method of addressing a high load of patients requiring pain relief was considered one of the main inhibitors to provision of restorative care. It has been established that extracting teeth requires on average 7 min. and restoring teeth (including ART), between 15 and 20 min (22). Patients' demands for pain relief through extraction do influence operator choice in relation to using restorative treatment of tooth cavities.

- *2. Operator opinion* - A general lack of motivation and a negative opinion amongst operators concerning the adoption of new treatment methods may result in resistance to using new clinical procedures such as ART (23).

- *3. Patient opinion* – Under the previous political system in South Africa the delivery of well-organized oral care was restricted to a small percentage of the population. The large majority was not introduced to oral health promotion and preventive services. They accepted that a visit to a dentist was needed only when one had toothache and that tooth extraction was the sole treatment to be provided. Furthermore, owing to the scarcity of dental clinics in rural and peri-urban areas, patients have to travel long distances. Because of the high number of patients seeking dental care, many have to wait long hours before being attended to. As most of these patients are poor, costs of travel to the dental clinics are considered to be very high. For these reasons, most patients report for dental treatment at a stage when tooth extraction is usually the only possible treatment left. In addition, many patients may prefer the removal of a decayed tooth to restoration of the cavity, as the latter may need to be repaired later and thus require an additional visit to the clinic, costing time and money. For the same reason, patients may refuse restorative treatment of carious teeth diagnosed during a visit to the dentist for an extraction, regarding them as unproblematic.

- 4. *Oral health service management* - A lack of resources may lead to insufficiencies in oral healthcare management. Inefficient management may lead to a lack of operator guidance and leadership with respect to the implementation of new treatment methods, such as those used in the ART approach. After having accepted a new method, health authorities should include the method into its list of standards-of-care, providing treatment guidelines and targets, and monitoring implementation. Without such guidance operators may think that the authorities are not serious about the new method and ignore it in their daily practice.
- 5. *Material supply* - Late or irregular supplies cause shortages of materials and instruments necessary to provide a treatment. Introducing a new treatment method often goes hand-in-hand with the necessity to order new materials and instruments. If ordering and supplying is not well organised, a new treatment method will have a difficult start; for example, a high-viscosity glass ionomer, that may not initially be available in the clinic, is needed for ART.
- 6. *Clinical ART skill* - It is recognized that ART, like traditional restoration, can fail because of operator-related factors (24). Insufficient skills and/or diligence in performing ART will lead to restoration failures that, in turn, may generate a negative feedback which may result in reduced motivation of the operator to continue applying the ART approach instead of resorting to well-known traditional treatment methods.
- 7. *Chair-side assistance* - A lack of effective chair-side assistance results in operators' having to perform assisting functions, such as mixing filling material themselves. This would increase the operator time required for treating patients and, in order to avoid that situation, lead them to resort to less time-consuming procedures, such as using rotating instruments.

Evaluation

In order to evaluate the barriers identified, a 30-item questionnaire was developed and piloted (Annex 1). One year after completion of the ART training, operators were asked to fill in the questionnaire using the 5-point Lickert scale. A trained field worker distributed and collected the questionnaire. In order to quantify the value of each barrier, responses were

ranged from 1 = no barrier to 5 = highest barrier. For each operator, dental treatment records; including the number of extracted teeth, number of restorations placed through the traditional and ART approach for both primary and permanent dentition, were collected over a one year period after completion of the ART training (August 2001 – July 2002).

Statistical analysis

The analysis was done by a biostatistician (MvH). Based on the collected statistics, the restoration / extraction (REX) ratio and the proportion of ART restorations to the total number of restorations per operator were calculated and correlated with the barrier variables, using the Pearson correlation coefficient. In the same way the barrier variables were correlated with each other. Differences between the mean barrier values were tested, using ANOVA and the 2-tailed t-test. Statistical significance was set at the 5% level. The overall Cronbach's alpha for the questionnaire was 0.7, indicating a high reliability level in the data obtained.

Results

Operator information

Two operators did not complete the questionnaire and were excluded from the analysis. Of the remaining nineteen dental operators, 58% were female and 42% were male. Their mean age was 39.8 (SD = 9.6) years; mean number of years graduated, 14.3 (SD = 9.8) years; mean number of years spent working at the clinic in Ekurhuleni, 10.3 (SD = 8.3).

Oral treatment

The mean number of patients treated per day by each operator was 26 (SD = 8). Tooth extraction was the most frequently performed treatment (Table 1). Most of the restorations were placed using the traditional approach under local anaesthetics. The mean numbers of traditional restorations in permanent and primary teeth per operator were 190 (SD = 313) and 18 (SD = 28), respectively.

ART restorations were the main type of restoration placed in the primary dentition. On average, each operator had used the ART approach to

place 68% of all restorations in primary teeth and 13% of all restorations in permanent teeth.

The barrier factor *patient load/work load* had the highest mean value: 2.80 (SE = 0.16), whereas *clinical ART skill* scored lowest; 0.47: (SE=0.14). A statistically significant difference existed between the mean score of the barrier factor, *patient load/work load*, and the mean scores of the other barrier factors (ANOVA; t-test $p<0.001$). The mean score of the barrier factor, *clinical ART skill*, was statistically significantly different from the mean scores of all the other barrier factors (ANOVA; t-test $p<0.001$). Figure 1 shows a box-plot of the barriers under study.

Table 1: Mean scores and Standard Deviation (SD) of treatments provided per operator and per dentition during a 12-month post-ART-training period

Primary dentition		
Type of treatments	Mean	SD
Extractions	474	244
Non-ART restorations	18	28
ART restorations	39	58
Restoration - Extraction ratio (REX)	0.17	0.24
Proportion of ART restorations of total number of restorations placed	68%	27%
Permanent dentition		
Type of treatments	Mean	SD
Extractions	1941	891
Non-ART restorations	190	313
ART restorations	29	59
Restoration - Extraction ratio (REX)	0.18	0.39
Proportion of ART restorations to total number of restorations placed	13%	22%

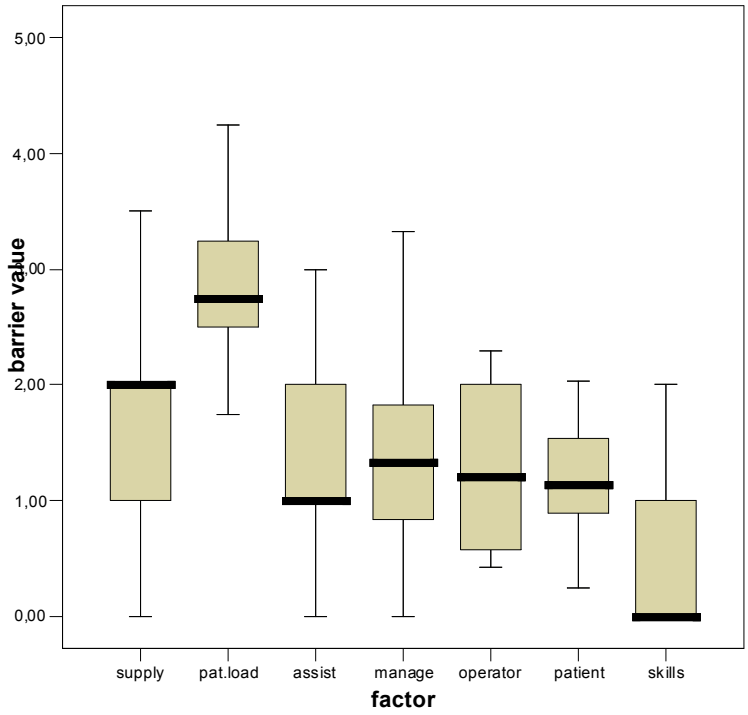

Figure 1: *Box-plot for the barrier factors under study as assed through the participant questionnaire*

Barriers to implementing the ART approach

One operator did not respond to the questions about patient load and operator opinion.

A significant correlation between *material supply* and the mean REX score in primary dentitions (r -0.49; $p<0.05$) and in permanent dentitions (r = -0.48; $p<0.05$) was observed (Table 2). In primary dentitions, the proportion of ART restorations correlated significantly with *clinical ART skill* (r= -0.63; $p<0.01$). In permanent dentitions, statistically significant correlations were observed between the proportion of ART restorations and the barrier factors *patient load/work load* (r = -0.54; $p<0.05$), *patient opinion* (r = -0.76; $p<0.01$), *operator opinion* (r = -0.53; $p<0.05$), *chair-side assistance* (r = -0.57; $p<0.05$) and *oral health service management* (r = -0.46; $p<0.05$).

Table 2: Correlations between barrier factors and mean REX scores and the proportion of ART restorations in relation to the total number of restorations placed per dentition

Primary dentition		
Barrier factors	Mean REX score	ART % of the total number of restorations placed
Total	-0.15	-0.58*
High patient load	-0.17	-0.31
Negative operator opinion	-0.35	-0.40
Negative patient opinion	-0.06	-0.34
Insufficient service management	-0.06	-0.33
Material supply problems	-0.48*	-0.40
Insufficient clinical ART skills	-0.19	-0.63**
Insufficient chairside assistance	-0.29	-0.15
Permanent dentition		
Barrier factors	Mean REX score	ART % of the total number of restorations placed
Total	-0.35	-0.84**
High patient load	-0.39	-0.54*
Negative operator opinion	-0.39	-0.53*
Negative patient opinion	-0.13	-0.76**
Insufficient service management	-0.04	-0.46*
Material supply problems	-0.49*	-0.29
Insufficient clinical ART skills	-0.30	-0.44
Insufficient chairside assistance	-0.03	-0.57*

p-value: Pearson correlation test: *0.01<p<0.05, **p≤ 0.01

Correlations among all barrier factors are shown in Table 3. Statistically significant correlations were observed between *patient load/work load* and *operator opinion* (r= 0.70; p<0.05) and between *patient load/work load* and *patient opinion* (r = 0.73; p<0.01). There was a significant correlation between the barrier factors, *operator opinion* and *patient opinion* (r = 0.77; p<0.01).

The barrier factors, *oral health service management,* correlated significantly with *operator opinion* (r = 0.52; p<0.05) and *patient opinion* (r = 0.57; p<0.01).

Table 3: Correlation coefficients and p-values (%) of the seven barrier factors

p-values (%)

Barrier factor	Patient load	Operator opinion	Patient opinion	Service management	Material supply	Clinical ART skills	Chairside assist
Patient load		0.1%	0.1%	29.3%	9.9%	11.1%	50.2%
Operator opinion	0.70*		0.0%	2.6%	33.1%	6.9%	66.3%
Patient opinion	0.73**	0.77**		1.1%	46.4%	9.4%	7.5%
Service management	0.26	0.52*	0.57**		51.8%	37.1%	16.1%
Material supply	0.40	0.24	0.18	-0.16		11.3%	43.5%
Clinical ART skills	0.39	0.44	0.40	0.22	0.38		91.3%
Chairside assistance	0.17	0.11	0.42	0.43	-0.19	-0.03	

Correlation coefficients

Discussion

This study assessed the effect of possible barriers upon the low level of utilisation of the ART approach observed in a regional public oral health service system of South Africa. In the data analysis a common phenomenon that warrants discussion was encountered. ANOVA should be used when the means of three or more groups need to be compared. However, a prerequisite is the need for a near to equal variance of the group variables. This was not entirely the case in 3 of the 7 factors in the present study. However, the fact that the use of ANOVA indicated a very strong difference ($p<0.001$) between the groups shows that the barrier factors, *patient load/work load* and *clinical ART skill,* indeed differed significantly from the other barrier factors, although the real level of significance would have been somewhat higher. In order to ensure a true difference between the *patient load/work load* and *clinical ART skill* barriers and the remaining barriers, the t-test was applied. The mean score of *patient load/work load* was compared to that of the next highest mean score (*material supply*), and the mean score of *clinical ART skill* was compared to that of the next lowest mean score (*patient opinion)*. Both comparisons yielded a highly statistically significant difference ($p<0.001$). Obviously, therefore, *patient load/work load* and *clinical ART skill* were the

two barriers that had the most and the least influence respectively on the implementation of ART in the public oral healthcare system studied.

The barrier factors under study appeared to have less influence in inhibiting the utilisation of ART in primary dentitions of children than for adults. It has been shown that children accept the ART procedures better than they accept traditional restorative procedures (25,26) and, furthermore, they respond more fearfully to invasive procedures, such as injections and high speed drilling, than most adults do. As patient anxiety is directly related to operator stress (27-30), operators may have tried to reduce stress by using the ART approach, which may explain the higher use of ART in treating children than in treating adults.

However, that issue was not relevant for all dentists under study, as it was also shown that operators' clinical skills in mastering the ART procedures were the only factor that influenced the utilisation of ART in children. Dentists who perceived their levels of ART skills to be low produced fewer ART restorations in primary teeth than colleagues more confident in applying ART. The three days allocated to the ART training may have been insufficient for a number of dentists and dental therapists to master the clinical skills necessary for performing ART in children with sufficient confidence: particularly, those apprehensive about treating children through traditional restorative procedures. Those desiring to improve their skills in treating them would probably have benefited from a follow-up meeting after some months or from extension of the initial training course by a couple of days geared towards providing more practical training.

Adult patients' generally less fearful response to invasive traditional dental treatment may have reduced the need for operators to resort to the use of ART in treating them. Lower utilisation of ART for permanent teeth in adult patients than in children may also be due to the operators' perception that ART is more appropriate for use in primary than in permanent teeth.

Material supply was the only factor that inhibited the provision of both ART and traditional restorative care in both dentitions, relative to tooth extraction. A low availability, or even absence, of materials/instruments needed to perform restorations, resulted in dentists' performing more extractions than restorations. It is obvious that the lack of a sufficient

restorative material and instruments/equipment supply to clinics prohibited operators from implementing restorative care.

The strongest barrier factor affecting implementation of the ART approach in the health services was the *high patient load/work load*. Other barrier factors that significantly hindered the use of ART in permanent teeth were *operator opinion*, *patient opinion*, *oral health service management* and *chair-side assistance*. Not surprisingly, having to treat a high number of patients daily creates treatment-time pressure on operators and results in long waiting times for patients. Under such circumstances it is difficult to introduce new treatment methods, such as the ART approach uses. If at the same time services are insufficiently managed and chair-side assistance is inadequately available, operators are hardly likely to regard introducing a change as beneficial. This means that if the health authorities would like to improve the oral health services through increasing the number of restorations and reducing the number of extractions, they will have to employ more dentists and supporting staff and ensure availability of sufficient materials, instruments and functional dental equipment, in addition to providing support through guidance and leadership. Without specific guidelines and targets, and a monitoring system managed by health authorities, operators tend to ignore the necessity to introduce new methods in their daily practice and may do little to inform patients about their benefits.

A general resistance by operators towards adopting changes into their daily dental practices may also have particular importance in causing negative operator opinion of ART. Such resistance may not be specific to ART but related to psychosocial factors which influence the spread of innovations. Innovations, such as the ART approach, may be perceived either as improvements or as disruption (31). Either perception depends upon the existence of obvious disadvantages of traditional methods in comparison to innovation (31). If any such disadvantages are perceived to be absent, an innovation may often be rejected despite its advantages in other fields. Furthermore, the reasons for adoption or rejection may also depend upon interpersonal communications between operators about their clinical experiences, and upon the influence of opinion leaders and experts (31).

Disagreements between experts may lead to operator insecurities about innovations and thus also hinder their adoption (32).

In view of the above, possible barriers should in future be identified before introducing the ART approach into a public oral health service system. The types and effects of barrier factors may differ from situation to situation. Such information would prove useful to those deciding whether barrier factors can be addressed and whether the implementation of the ART approach after training is likely to succeed or fail. Van Palenstein-Helderman *et al*. (2003) confirmed that experience in implementing ART in the oral healthcare system, particularly in relation to its effectiveness, efficiency and sustainability under local conditions (33), is lacking. In addition to an initial situation analysis, small-scale demonstration projects could help in revealing potential barriers. In order to address general resistance to change, interactive hands-on training, followed by continued refresher courses and encouragement of interpersonal communications, should be encouraged as these measures have been shown to be effective (34).

Conclusions

It was concluded that an inadequate supply of dental materials inhibits the provision of restorative care in relation to tooth extractions for both adult and child patients. Dentists' perceptions of low levels of clinical skills in performing ART confidently after training constitute a barrier to utilising ART in children. High patient load/work load, negative operator and patient opinion, insufficient chairside assistance and poor management of services by health authorities were factors that inhibited the proper utilisation of ART among adults in the public oral health service of the Ekurhuleni region 12-months post-ART training.

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CHAPTER 7

Summary, General discussion and Conclusion

Summary

Before 1994, most of the population in South Africa had little access to preventive and curative oral healthcare. The main reason for visiting a dentist was to have a painful tooth extracted. After Apartheid, the policy of equal access to oral health services for all South Africans was introduced. Nevertheless, in the present public oral health service system, tooth restorations to tooth extractions are rendered in a ratio of one to nine, despite the availability of dental equipment for performing traditional restorative treatment. According to the National Oral Health Survey of 1988/9, the need for tooth restorations was, however, twice as high as the need for tooth extractions. Such a discrepancy between the actual treatment pattern and the one based on epidemiological normative needs can be ascribed, amongst others, to the insufficient number of dental operators and ancillary staff employed in the public service, which obviously results in a high workload and to patients who do not consider restorative treatment a high priority.

Since the publication of the National Oral Health Survey, the Department of Health has formulated oral health goals for the year 2010. These include: an increase in primary health care facilities for delivery of oral health care; an increase in the percentage of children at age 6 who are caries-free to 50%; reduction in the mean DMFT score at age 12 to 1.0. In addition, the Department of Health has developed plans to strengthen basic curative services by ensuring that all clinics offer a standardized primary oral healthcare package. This package includes basic treatment services, consisting of oral examination, taking bitewing radiographs, scaling and polishing, providing emergency relief of pain and sepsis and placing simple (1-3 surface) restorations. It has been suggested that the Atraumatic Restorative Treatment (ART) approach be used to attain the requisite preventive and restorative care. The ART approach was introduced in the country in 1996 and was adopted by representatives of all dental schools in the country as a feasible treatment approach. However, as no information was available on the introduction of the ART approach in public oral healthcare systems, there was a need to assess its impact. This PhD study aimed to investigate the impact of introducing the ART approach on the tooth

restoration and extraction pattern under conditions of a provincial public oral health service in South Africa.

In order to test the effect of ART on the pattern of restorative care, a pilot study was conducted under the conditions of an academically organised Mobile Dental System - MDS (**Chapter 2**). Since 1985, the Division of Public Oral Health of the University of the Witwatersrand, Johannesburg, has managed the MDS in communities with low socio-economic backgrounds around Johannesburg. Oral treatment was provided, using a Mobile Dental Unit (MDU) that consisted of four fully equipped dental clinics, and was operated by a team of three dental operators, a dental assistant and supporting staff. In 1996, all dental operators were trained in ART and carried out this type of procedure alongside other restorative procedures. In the following year, ART was considered the main type of restorative treatment. Records were kept of all oral procedures carried out between 1995 and 1997. Three appropriate one-year data collection periods were identified: Before ART was introduced - 1996 (A); Gradual ART adaptation period - 1997 (B) and Full inclusion of ART - 1998 (C). Operators were free in their choice of treatment and use of restorative material. Comparison of the treatment profile during the periods A and C assessed the effectiveness of the introduction of ART into the mobile oral care system. A five-point questionnaire was used to interview operators, in order to assess the reasons for changes in treatment. Questions were related to the length of time they had worked in the MDU, their personal choices in treating primary and permanent teeth and their reasons for choosing particular treatment procedures. The mean restoration / extraction ratio (REX) increased from 0.37 in period A to 1.15 in period C. This was due to a decrease in the percentage of tooth extractions and an increase in the percentage of restorations in both dentitions ($p < 0.0001$). In period C, ART was the predominant rendered type of treatment (45.4%) and the proportion of ART to the total number of restorations was 98.2%. All respondents indicated ART restorations to be their present choice of treatment for carious single- and multiple-surface lesions of posterior teeth. The reasons governing this choice included improved properties of glass-ionomer cements and the absence of the need to have to administer local

anaesthesia, because placing ART restorations turned out to be almost painless.

In order to study factors driving the current manner of providing oral care in the services in more detail, information was collected on dental operators' opinions related to their working conditions and the restorative care provided in a provincial public oral health service system (**Chapter 3**). The study was carried out in Gauteng Province, in the north-east of South Africa. In 2001, forty-one dental operators from three of the five regions of the province participated. A questionnaire was used to elicit information from them about their own levels of occupational stress and their opinions about the main reasons for stress experienced during daily work. Information concerning the treatment provided was collected per operator from the dental clinic records over a 4-month period. The results showed that the mean number of patients treated daily, per operator, was 26 (SD = 8.4). The mean level of occupational stress, measured on a scale ranging from 1 (no stress) to 10 (intensive stress), was 4.9 (SD = 1.9). Most operators regarded high dental anxiety of patients as the main reason for their own perceived stress, followed by high patient loads. The main type of treatment provided was tooth extraction. The mean level of operator stress increased with an increase in the number of patients treated per day ($r=0.44$; $p=0.004$), and with an increase in the number of teeth extracted per day ($r=0.41$; $p=0.008$). It was concluded that restorative care in this public oral health service system was limited and that tooth extraction was the treatment predominantly provided. A high patient load and a high level of dental anxiety among patients emerged as determinants of this situation. It was recommended that health authorities should introduce appropriate measures in order to address the prevailing situation adequately.

Based on the results of the pilot study in Chapter 2, a study was set up with the aim of assessing the effect of a single 3-day ART training course on the treatment pattern of dental operators in a regional public oral health service system after a period of 12 months (**Chapter 4**). A test group, consisting of 21 operators from the Ekurhuleni region of Gauteng Province, was trained in ART, according to recommended standards. The control group consisted of 20 operators from 2 other regions of the same province. Clinic

records containing the number of restored and extracted teeth and the type of restoration per dentition were collected 4 months before, and 12 months after the ART training, in the test group, and over comparable periods in the control group. The difference in the restoration/extraction (REX) ratio after and before the ART training was compared between the test and control groups. No difference was observed in the mean increase in the primary dentition REX score in the test group (0.06; SD = 0.17) and in the control group (0.03; SD = 0.34). In the permanent dentition, the mean increase in REX scores in the test and control groups was 0.03 (SD=0.16) and 0.01 (SD = 0.09), respectively. The proportion of ART restorations in the total number of restorations placed in primary and permanent teeth was 67% and 11% respectively, over the 12-month post-ART training period. The study showed that a single ART training course had not changed the overall restoration-extraction pattern of dental operators in a regional public service after 12 months.

In the next investigation **(Chapter 5)** two hypotheses were tested: 1) The use of ART results in lower levels of patient anxiety and 2) it results to higher REX scores. The test group consisted of 9 dental operators who were trained in ART, unlike the dental operators in the control group (n =11), who were not trained in ART and did not apply it. The Children's Fear Survey Schedule/Short Form (CFSS-SF) scale and CORAH's Dental Anxiety Scale (DAS) were used to assess patient anxiety after restorative treatment using ART (test group) and after use of the traditional approach (control group). The REX score for primary and permanent dentitions per operator was calculated for both study groups, using treatment statistics collected over a 12-month post-ART-training period. The mean CFSS-SF score for the test group children was statistically significant (p=0.001): lower (14.8: SE = 1.7) than for the control group (24.4: SE = 1.2). The mean DAS score for the test group adults (6.7: SE = 0.4) was statistically significantly (p=0.0005) lower than that of the control group (9.3: SE= 0.2). No significant correlation was observed between dental anxiety and REX ratio per operator for both dentitions in both groups. And there was no difference in the mean REX score between test and control groups. The first hypothesis was accepted and the second was rejected. Although dental anxiety scores were lower in child and adult patients

treated by ART than in those who received traditional restorative treatments, this positive effect had not resulted in higher REX scores.

The reasons for the inhibition of change by operators in their treatment patterns after ART introduction were further investigated (**Chapter 6**). Seven factors related to the provision of service were identified, on the basis that these might exercise an inhibitory influence (barrier effect) on the utilization of ART by dental operators in public health services in the Ekurhuleni region of Gauteng Province. The factors were: patient load / work load; operator opinion; patient opinion; oral health service management; material supply; clinical ART skill; chair side assistance.

In order to evaluate the barriers identified, a 30-item questionnaire was developed and piloted. Operators were asked to complete each question according to the 5-point Lickert scale, 1 = no barrier to 5 = highest barrier. The questionnaire was administered and collected by a trained fieldworker one year after ART training. For each operator, dental treatment records; including the number of extracted teeth and the number of restorations placed through the traditional and ART approach for both the primary and permanent dentition, were collected over a one year period after completing ART training. Using the collected statistics, the REX score and the proportion of ART restorations to the total number of restorations were calculated and correlated with the barrier variables. Operators rated the barrier patient load/work load highest (mean = 2.80; SE = 0.16), and clinical ART skill lowest (mean = 0.47; SE = 0.14). One year after ART training, insufficient supply of dental materials inhibited the provision of restorative care in relation to tooth extractions both for adult and for child patients. Dentists' perceptions of low levels of clinical ART skills was a barrier to using ART in children and high patient load, negative operator and patient opinion, insufficient oral health service management by health authorities and insufficient chair side assistance were factors that inhibited the proper utilization of ART among adults in the public oral health service of the Ekurhuleni region 12-months after ART training.

General discussion and conclusion

An increase in restorative care in relation to tooth extractions, expressed in the REX score, was observed one year after the ART approach was introduced into a community oral health outreach programme (**Chapter 2**). The increase in the REX score was higher for primary than permanent teeth. It was the operator's opinion that these changes were due to the less threatening nature of ART. Patients preferred ART to the conventional way of restoring tooth cavities. The conventional restorative treatment goes hand in hand with invasive procedures such as administering local anaesthetic injection and drilling in tooth tissues. Patients, particularly children, often responded to such an invasive treatment with discomfort and anxiety. In contrast, the use of ART created a more relaxed atmosphere in which injecting was limited and drilling absent. In the South African context, where extraction is rather the rule for treating toothache than the exception, ART supports the operator's intention to save the patient from premature tooth loss. A possible explanation for the higher REX score in primary teeth than in permanent teeth is the fact that children generally are more anxious about undergoing invasive dental treatment than adults are. The effectiveness of introducing ART, its applicability and the transferability of inducing a higher REX score in a South African public oral health service was investigated in this thesis.

The use of ART has been reported to be less painful (1-5) and it has been associated with a lower level of dental anxiety compared to conventional restorative treatment (6,7). An association between patient dental anxiety and operator stress has been reported (8-14). Less or no dental anxiety has been associated with better patient behaviour and cooperation (15-17) and good patient cooperation has been associated with less operator stress (18-20). On the basis of the associations mentioned above, it was assumed that dental operators would be motivated to choose ART as a treatment for painful, non-pulpal infected teeth instead of conventional restorative treatment and to use it more frequently. Such a choice would lead to an increase in the number of restorations and, subsequently, to a higher REX score. The conceptual framework of associations and hypothetical interactions between the use of

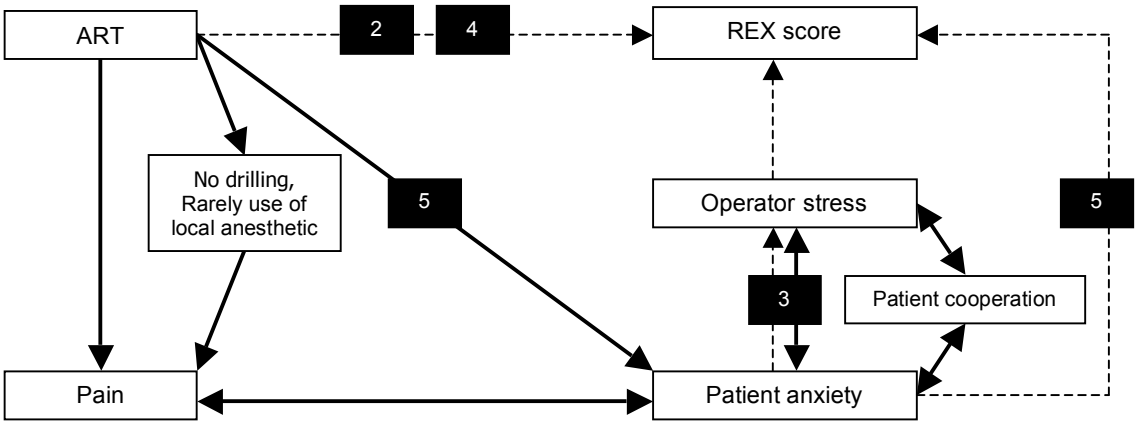

Figure 1. *Conceptual framework of associations and hypothetical interactions between components*

Associations between components based on existing evidence;

Causality between components;

Hypothetical interactions;

Interactions investigated in this thesis (per chapter):

2 *Chapter 2* 3 *Chapter 3* 4 *Chapter 4* 5 *Chapter 5*

the ART approach, patient dental anxiety, operator stress and REX scores in a public oral health service system is shown in Figure 1. This framework is discussed below.

Conceptual framework

Although there is evidence for the existence of associations between some of the components in the conceptual framework, the current literature provides no evidence for causal interactions, neither does it provide evidence in support of any association or causal interactions between the introduction of ART, operator stress and REX score in a public oral health care service system. There are a number of factors that may influence the hypothetical interactions in the South African context, which require discussion.

It has been mentioned before (**Chapter 1**) that over 80% of South Africans rely on the public oral health care service, which in itself faces a long-

existing lack of resources (21-23). For example, the service faces a shortage of dental operators. This, combined with an increasing number of patients seeking care at state clinics (24), results in a high operator workload (22). Most of the patients visit the dental clinics for pain relief and demand tooth extractions as the treatment to be used (22). It is, therefore, not unrealistic to raise the question of whether operators have sufficient time to introduce and apply a new treatment like ART and, subsequently, increase the number of restorations relevant to extractions. The fact that Black Africans constitute most of the outpatients (25), who traditionally demand extraction rather than a restoration (26), makes an increase in the REX score more difficult to achieve. Furthermore, patients may be unaware that toothache can be treated through a restoration and, therefore, do not present for restoration of a tooth cavity. Although ART is less painful than the traditional restorative treatment, the mentioned factors may hinder an increase in REX score shift from extraction to restoration, as observed in the community oral health outreach programme (**Chapter 2**).

From the operators' point of view, patient anxiety may not always be regarded as the main reason for their stress felt when having to provide restorations in the public services. Rather, lack of resources (24), such as instruments and restorative material needed to place ART restorations, may hinder ART utilisation, even in cases where ART has led to a reduction in stress levels. The effect of these possible barriers has been described in **Chapter 6**.

Study outcomes

This PhD study was the first attempt to investigate the effects of introducing ART into a South African public oral health service. The results of the investigation have shed light on a number of the hypothetical associations presented in the conceptual framework. These results are mentioned below.

1. The REX score is increased after ART introduction into an academic service environment (**Chapter 2**) but no increase was observed after ART was introduced in the public oral health service system (**Chapter 4**);

2. Some operators used ART more than others, particularly in child patients. (**Chapter 4**);
3. There is an indication that tooth extraction and patient anxiety are associated with operator stress (**Chapter 3**) and that ART is associated with less patient anxiety (**Chapter 5**).

Quality of investigations

Considering the complexity of investigating the introduction of a new treatment approach (ART) into an existing service system, the quality of the research methodology used is discussed chapter by chapter in the following pages.

Chapter 2

In this chapter, the effect of the introduction of ART in a controlled environment of an academic community oral health outreach programme (MDS) was described.

A limitation of the study design was the lack of a control group. This lack made it difficult to judge whether the observed increase in REX score was indeed due to the introduction of ART, and not to operator's driving force to provide more restorative treatment within the context of the study aims. For this reason the internal validity of this study should be considered low. It must be understood that the study had an exploratory character: to obtain insight into whether ART would, in anyway, be accepted by the operators and the patients. The observation that ART was indeed accepted warranted further investigation. In hindsight; concentrating research on this internal validity issue would have been a better option than embarking on further investigations regarding the applicability of ART in the South African public health service system.

Chapter 3

In this chapter, operator stress was assessed, using a questionnaire with pre-selected stressors (8,27) originating from a validated questionnaire for use in private dental practice in South Africa (27). Stressors that were not relevant to the public health sector; such as those related to securing sufficient income

and the necessary number of patients, and having patients keep their appointments had been deleted from the original questionnaire. It could be argued that the validity of the questionnaire used in the present investigation was not well-established. On the other hand, the stressors included were very relevant to the conditions present in the public oral health service. Outcomes of stress assessments in the literature are obtained from settings that are different from those in the public oral health care in South Africa.

The use of closed questions for operator stress assessment has been applied in previous research (11). However, it has the disadvantage that a wider range of possible reasons for stress is excluded. The use of a generally applied questionnaire for assessing stress factors with relevance for the South African public oral health service would have been preferable but such a questionnaire was not available.

The main reasons for stress, as perceived by the operators, were patient anxiety and workload. Since patient anxiety is not investigated, only a positive association was found between stress levels, number of patients treated and number of teeth extracted per day. It implies that the outcomes regarding perceived stress by operators provide only limited validation.

Chapter 4

In this chapter, the effect of the introduction of ART into the South African public dental health service system was described. The results indicate that the introduction of ART induced a shift in operators' treatment pattern: from conventional restorations to ART, particularly in the primary dentition. However, this shift was less pronounced than the one seen in the pilot study. In the pilot study only a small, not randomised, group of operators was involved, which possibly induced a selection bias of enthusiastic ART providers (28). Other confounding factors, such as the different environments of the communities visited, despite these being of the same low socio-economic background, may have played a role. These factors may have induced different treatment needs and treatment demands. Conditions in the public dental health clinics, like workload, service management, material supply, clinical ART skills and chair-side assistance, were not completely similar to the conditions in the academic community health outreach clinic of

the pilot study. The described factors are likely to have been responsible for the limited external validity of the outcomes of the pilot study.

In contrast to the pilot study (**Chapter 2**), the shift from conventional restorations to ART in the public dental health service did not result in higher REX scores. The not completely similar conditions under which both studies were operating and the previously mentioned limited internal validity of the pilot study are reasons for a lack of transferability of the outcomes of the pilot study to the public oral health service system.

Chapter 5

Some of the difficulties encountered in carrying out the study regarding associations between ART and patient dental anxiety in the setting of a public oral health system have been described in the relevant publication. A methodological aspect has received insufficient attention and is, therefore, discussed below. The effect of ART on patients' anxiety would ideally be assessed using a pre- and post-test measurement. However, only a post-test was performed. Validated scales, such as the DAS and CFSS-SF, are designed to assess trait fear specifically related to a dental procedure (29). Trait fear of invasive dental procedures, as experienced by patients after tooth tissue drilling, has been associated with patient dental anxiety (6,7). In order to assure highest validity for the assessment of dental anxiety, the use of validated scales should be undertaken immediately after the dental treatment (30) and not before. Patients may experience anticipatory anxiety prior to treatment, which may mask the actual trait fear experienced with regard to a specific dental procedure (29). In order to conduct a valid pre-test in this study, patients' trait fear of conventional dental treatment, in both the control group and the test group, needs to be assessed first. This should have been followed by a second dental visit after some days, in which trait fear for conventional restorative treatment and for ART, should have been assessed for the control and test group, respectively. The problem in the South African public oral health care service is that very few patients attend the clinic for restorative treatment. This was also evident in the present study, since only 5 operators in the ART group had placed restorations on the assessment days. Attempts to recall patients in Africa for restorative dental treatment only,

usually fail because of low adherence to recall visits (31). The particular setting in which this investigation was performed therefore hindered patient recall and thus the possibility to carry out a pre test.

The difference in assessed levels of dental anxiety between the ART and conventional restorative treatment groups is pronounced. It is very likely that almost all patients in both groups were first-time restoration receivers. It can, therefore, be argued that under the conditions in the South African setting, the absence of a pre-test is of lesser importance than in societies where people have undergone all kinds of invasive dental treatment.

Chapter 6

Factors that may hinder a smooth introduction of ART into the South African public oral health service have been described in this chapter. The results were obtained through the use of one single questionnaire assessing operators' opinions regarding a number of potential barrier factors but these had not been verified from relevant records available in the oral health service system. For example, the availability of sufficient instruments and materials to carry out ART can easily be checked from records. Such a check would have improved the quality of the data obtained.

The outcome of this exploratory study on barrier factors is multi-interpretable, since no single barrier factor or combination of factors could give a satisfactory explanation for the relatively low application of ART and the unchangingly low REX score. It is therefore concluded that the described barrier factors, and possibly, other unconsidered factors such as: low salaries; lack of incentives to provide more restorative treatment, including ART; lack of indication for restorative treatment among the visiting patients and low professional development opportunities in the service, may all contribute to a complex interplay that has hindered the provision of restorative treatment. Further, more comprehensive research in this field is needed. In-depth interviews of operators and the responsible health decision-makers are warranted (9,10): about experienced operator stress (32), job satisfaction (33) and factors that may improve the work conditions and the provision of services. Such qualitative research would provide a better understanding of how decision-makers and operators reflect the current public oral health

service and work environment and provide a basis for choosing appropriate interventions.

Research in (African) public oral health services – a dilemma

Randomised controlled study designs have become the 'gold standard' in research (34). However, the application of such high quality study design is often logistically impossible and unaffordable owing to limited resources (35). To wait until evidence from high quality studies based on sufficient resources becomes available, may be regarded as unethical (35). It has been argued that randomised control trials are unable to address questions of effectiveness and efficiency of clinical interventions in health care systems adequately (34) because of the problem of applicability and transferability. The research in this thesis should be considered in this context.

Conclusion

On the basis of the results of this PhD research, it is concluded that a thorough situation analysis should precede the introduction of the ART approach into a public oral health service system, particularly in systems with a continuous lack of resources. If such an analysis identifies potential inhibiting factors for an increase in restorative care and these factors cannot be adequately controlled, it is unlikely that the introduction of ART will yield optimal results.

The content of this thesis indicates that a single 3-day ART course, approval from the authorities to introduce changes in the care system and the presence of necessary instruments and materials for ART in itself are insufficient conditions for an effective introduction of ART in the South African public oral health care system.

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Samenvatting, algemene discussie en conclusie

Samenvatting

Voor 1994 was preventieve en curatieve mondgezondheidszorg voor het overgrote deel van de Zuid-Afrikaanse bevolking beperkt toegankelijk. De belangrijkste reden om naar de tandarts te gaan was om een pijnlijk gebitselement te laten extraheren. Na de Apartheid werd de mondgezondheidszorg voor alle Zuid-Afrikanen gelijkelijk toegankelijk. Desondanks is de verhouding restauraties/extracties 1 op 9 in de huidige publieke mondgezondheidszorg, terwijl er geschikte tandheelkundige apparatuur beschikbaar is voor conventionele restauratieve behandelingen. Volgens het National Oral Health Survey uit 1988/9 was de noodzaak tot restauraties echter twee keer zo hoog als die voor extracties. Een dergelijke discrepantie tussen het huidige behandelingspatroon en dat gebaseerd op normatieve epidemiologische gegevens kan, onder meer, worden toegeschreven aan het tekort aan tandheelkundige zorgverleners (dentists en dental therapists) en hulpkrachten in de publieke zorg wat duidelijk leidt tot hoge werklast, en aan patiënten die geen hoge prioriteit geven aan restauratieve behandelingen.

Sinds de publicatie van het National Oral Health Survey heeft het Departement van Gezondheid doelen geformuleerd voor het jaar 2010. Deze houden in: een vergroting van de capaciteit van de eerstelijns gezondheidszorg, een verhoging van het percentage cariësvrije zesjarige kinderen tot 50 procent en een verlaging bij de twaalfjarige van de gemiddelde DMFT-score tot 1.0. Verder heeft het Departement van Gezondheid beleid ontwikkeld om de curatieve basiszorg te versterken door het voor alle klinieken mogelijk te maken een pakket gestandaardiseerde eerstelijns gezondheidszorg aan te bieden. Dat pakket bestaat uit oraal onderzoek, bitewing foto's, scalen en polijsten, pijn en sepsisbestrijding en een- tot drievlaks restauraties. Voorgesteld werd Atraumatic Restaurative Treatment (ART) te gebruiken om de vereiste preventieve en restauratieve zorg te verwezenlijken. ART is in 1996 in Zuid-Afrika geïntroduceerd en is door vertegenwoordigers van alle tandheelkundige opleidingen in het land als een haalbare behandelingsmethode geadopteerd. Omdat er echter geen

gegevens beschikbaar waren over het invoeren van ART in de publieke mondgezondheidszorg, bestond er behoefte aan onderzoek naar de impact ervan. Dit promotieonderzoek beoogt de impact te onderzoeken van de invoering van ART op de bestaande verhouding tussen restauraties en extracties in publieke provinciale klinieken voor mondzorg in Zuid-Afrika. Om de impact van ART op de huidige behandelingspatronen te onderzoeken is er een vooronderzoek gedaan in het kader van een academisch opgezet Mobile Dental System – MDS (**Hoofdstuk 2**).

Sinds 1985 leidt de Afdeling Publieke Mondgezondheid van de Universiteit van Witwatersrand, Johannesburg, het MDS in gemeenschappen met een laag sociaaleconomische achtergrond rondom Johannesburg. Een team gevormd door drie tandheelkundige zorgverleners, een tandheelkundig assistent en ondersteunende staf verleende er tandheelkundige zorg, waarbij gebruik werd gemaakt van een Mobile Dental Unit (MDU) bestaande uit vier volledig uitgeruste tandheelkundige klinieken.

In 1996 zijn alle tandheelkundige zorgverleners opgeleid in ART. Zij gaven deze behandeling naast andere restauratieve behandelingen. In het jaar daarop werd ART gezien als de voornaamste restauratieve behandeling. Van alle tandheelkundige behandelingen tussen 1995 en 1997 werden gegevens bijgehouden. Er werden drie afzonderlijke periodes van één jaar gekozen voor het verzamelen van gegevens: de periode voordat ART werd ingevoerd – 1996 (A); de periode waarin ART geleidelijk werd ingevoerd – 1997 (B) en de periode waarin ART volledig was ingevoerd – 1998 (C). Tandheelkundige zorgverleners waren vrij in hun behandelingskeuze en in het gebruik van restauratief materiaal.

Vergelijking van de behandelingspatronen in de periodes A en C moesten het effect van de invoering van ART in het Mobile Dental System uitwijzen. Door middel van een vijfpuntsschaal vragenlijst werden tandheelkundige zorgverleners geïnterviewd om hun beweegredenen voor veranderingen in de behandeling te achterhalen. De vragen waren gerelateerd aan hoeveel jaar zij al in de MDU /MDS werkten, hun persoonlijke keuzes bij de behandeling van tijdelijke en blijvende gebitten en hun beweegredenen voor het kiezen van een specifieke behandeling. De gemiddelde restauratie/extractie ratio (REX) nam toe van 0.37 in periode A tot

1.15 in periode C. Dit was het gevolg van de afname van het percentage extracties en de toename van het percentage restauraties in zowel het tijdelijke als het blijvende gebit ($p< 0.0001$). In periode C was ART de meest gegeven behandeling (45.4%) en het aandeel van ART in het totale aantal restauraties bedroeg 98.2 %. Alle respondenten gaven aan dat zij ART nu kozen als behandeling bij carieuze eenvlaks- en meervlakslaesies van elementen in het molaargebied. De beweegredenen voor deze keuze waren onder meer de verbeterde eigenschappen van glasionomeer vulmateriaal en het feit dat lokale verdoving overbodig was, omdat ART-restauraties zo goed als pijnloos bleken te zijn.

Om de factoren die bepalend zijn voor de huidige wijze waarop tandheelkundige zorg wordt verleend meer in detail te onderzoeken, werd de opinie gevraagd van de tandheelkundige zorgverleners ten aanzien van hun werkomstandigheden en de restauratieve zorg die zij verleenden in de publieke provinciale mondgezondheidszorg. (**Hoofdstuk 3**). Het onderzoek werd gedaan in de provincie Gauteng in het noordoosten van Zuid-Afrika. In 2001 namen er 41 tandheelkundige zorgverleners aan deel uit drie van de vijf provincieregio's. Aan de hand van een vragenlijst konden zij aangeven in welke mate zij werkdruk ervoeren en wat zij als de voornaamste stressfactoren zagen bij hun dagelijks werk. Van iedere tandheelkundige zorgverlener werden de gegevens over behandelingen, bijgehouden in de tandheelkundige kliniek, verzameld over een periode van vier maanden. Hieruit bleek dat er gemiddeld 26 patiënten per dag, per zorgverlener, behandeld werden (SD = 8.4). Het gemiddelde niveau van werkgerelateerde stress was 4.9 (SD = 1.9) gemeten op een schaal van 1 (geen stress) tot 10 (zware stress). De meeste tandheelkundige zorgverleners beschouwden angst voor de tandarts bij patiënten als de voornaamste reden voor de stress die ze ervoeren, gevolgd door de werklast veroorzaakt door veel patiënten. De meest gegeven behandeling was extractie. Het gemiddelde stressniveau steeg met het aantal per dag te behandelen patiënten ($r = 0.44$; $p= 0.004$), en met een toename van het aantal per dag geëxtraheerde gebitselementen ($r = 0.41$; $p= 0.008$). Het bleek dat restauratieve zorg in publieke mondgezondheidszorg klinieken beperkt was en dat extractie de overheersende vorm van behandelen was. Een hoge werklast door veel

patiënten en angst voor de tandarts bij veel patiënten bleken hiervoor doorslaggevende factoren. De overheid verantwoordelijk voor de volksgezondheid werd geadviseerd adequate maatregelen te treffen om de bestaande situatie te verbeteren.

Gebaseerd op de onderzoeksresultaten van de voorstudie beschreven in Hoofdstuk 2, is er een onderzoek opgezet met als doel de invloed te meten van een eenmalige driedaagse ART-cursus op het gangbare behandelingspatroon in de regionale publieke gezondheidszorg in de twaalf maanden volgend op de cursus (**Hoofdstuk 4**). Een groep bestaande uit 21 tandheelkundige zorgverleners uit de regio Ekurhulensi van de provincie Gauteng werd getraind in ART volgens de aanbevolen richtlijnen. Twintig tandheelkundige zorgverleners uit twee andere regio's van dezelfde provincie vormden de controlegroep. Van de proefgroep werden gegevens over het aantal restauraties en extracties en het type restauratie per gebit bijgehouden in de klinieken gedurende vier maanden voor en twaalf maanden aansluitend op de ART-cursus. Hetzelfde werd gedaan met de gegevens van de controle groep over vergelijkbare periodes.

De restauratie/extractie ratio voor en aansluitend op de ART-cursus werd vastgesteld bij de proefgroep en bij de controlegroep en vergeleken. Noch in de proefgroep noch in de controlegroep werd er verschil geconstateerd in de gemiddelde toename van de REX-score van het tijdelijke gebit (0.06; SD = 0.17) en (0.03; SD = 0.34). Hetzelfde gold voor de gemiddelde toename van de REX-score van het blijvende gebit, respectievelijk 0.03 (SD = 0.16) in de proefgroep en 0.01 (SD = 0.09) in de controlegroep. Het aandeel ART-restauraties van het totale aantal restauraties in het tijdelijk gebit was 67% en in het blijvende 11%. Dit onderzoek laat zien dat noch de restauratiebehandelingspatronen noch de extractie- behandelingspatronen van tandheelkundige zorgverleners in de desbetreffende regionale publieke zorgverlening in de twaalf maanden na een eenmalige ART-cursus waren veranderd.

In het volgende onderzoek (**Hoofdstuk 5**) werden twee hypotheses getoetst: 1) Het gebruik van ART resulteert in minder angst voor de tandarts en 2) Het gebruik van ART resulteert in hogere REX-scores. De proefgroep bestond uit negen tandheelkundige zorgverleners die getraind werden in ART,

terwijl de tandheelkundige zorgverleners in de controlegroep (n=11) geen ART-training kregen. De schaal van de Children's Fear Survey Schedule/Short Form (CFSS-SF) en de CORAH's Dental Anxiety Scale (DAS) werden gebruikt om de angst van patiënten te bepalen na een ART-behandeling (proefgroep) en na een conventionele restauratieve behandeling (controlegroep). Per tandheelkundige zorgverlener werd de REX-score berekend van het tijdelijke gebit en het blijvende gebit voor beide onderzoeksgroepen, waarbij gebruik gemaakt werd van de behandelingsgegevens over een periode van twaalf maanden aansluitend op de ART-cursus. De gemiddelde CFSS-SF-score voor de kinderen behandeld in de proefgroep (14.8: SE = 1.7) was statistisch significant lager (p=0.001) dan voor de kinderen behandeld in de controlegroep (24.4: SE = 1.2). De gemiddelde DAS-score voor de volwassenen behandeld in de onderzoeksgroep (6.7: SE = 0.4) was statistisch significant lager (p= 0.0005) dan die van de behandelden in de controlegroep (9.3: SE =0.2). Er werd geen significante correlatie gevonden tussen angst voor de tandarts en de REX-score per tandheelkundige zorgverlener in beide groepen, noch bij kinderen, noch bij volwassenen. En er was evenmin een verschil in de gemiddelde REX-score tussen de proefgroep en de controlegroep. De eerste hypothese werd aangenomen, de tweede verworpen. Hoewel de angst voor de tandarts resulteerde in lagere scores bij patiënten, zowel kinderen als volwassenen, die een ART-behandeling ondergingen vergeleken met patiënten die een conventionele restauratieve behandeling ondergingen, leidde dit positieve effect niet tot hogere REX-scores.

Wat de tandheelkundige zorgverleners ervan weerhield na de introductie van ART de gebruikelijke behandelingspatronen te doorbreken werd verder onderzocht (**Hoofdstuk 6**). Er konden zeven factoren onderscheiden worden in de relatie tot zorgverlening op grond van de veronderstelling dat deze factoren een negatieve invloed hadden op het gebruik van ART in de publieke mondgezondheidszorg in de Ekurhuleni regio in de provincie Gauteng. Deze factoren waren: werklast ten gevolge van veel patiënten; de opinie van de zorgverlener, de opinie van de patiënt; het management van de mondgezondheidszorg, de voorhanden zijnde materialen; klinische vaardigheid in ART en assistentie aan de stoel.

Er werd een vragenlijst met 30 items ontwikkeld en getest. Aan de hand van deze vragenlijst werd de impact van de bovenvermelde zeven factoren op de zorgverlening nader onderzocht. De lijst werd één jaar na de ART-cursus verspreid en ingenomen door een daartoe opgeleide veldwerker. De tandheelkundige zorgverleners werd verzocht iedere vraag te beantwoorden volgens de vijfpuntsschaal van Lickert, 1 (geen belemmerende factor) tot 5 (meest belemmerende factor). Van iedere tandheelkundige zorgverlener werden de behandelingsgegevens over de periode van een jaar aansluitend op de ART-training verzameld. Deze gegevens behelsden het aantal extracties en het aantal restauraties, conventioneel en ART, zowel voor het tijdelijke als het blijvende gebit.

Op grond van de verzamelde gegevens werden de REX-score en het aandeel van ART-restauraties in het totale aantal restauraties berekend en gecorreleerd aan de eerder genoemde belemmerende factoren. Tandheelkundige zorgverleners scoorden de belemmerende factor van de werklast ten gevolge van veel patiënten het hoogst (gemiddelde = 2.80; SE = 0.16), en klinische vaardigheid in ART het laagst (gemiddelde = 0.47; SE = 0.14). In het jaar volgend op de ART-cursus werd het gebrek aan tandheelkundige materialen als belemmerend ervaren bij de restauratieve zorg. Dit gold zowel voor de behandeling bij volwassenen als bij kinderen. Het lage niveau waarop de tandartsen hun eigen klinische vaardigheden in ART inschatten, was een belemmerende factor om ART toe te passen bij kinderen. Een hoge werklast ten gevolge van veel patiënten, een negatieve opinie van zowel zorgverleners als patiënten, gebrekkig management van de mondgezondheidszorg en onvoldoende assistentie aan de stoel waren factoren die het gebruik van ART bij volwassenen tegenhielden in de publieke mondgezondheidszorg in de Ekurhuleni regio in de twaalf maanden volgend op de ART-cursus.

Algemene discussie en conclusie

Er werd een toename gevonden in het aantal restauraties ten opzichte van het aantal extracties, uitgedrukt in de REX-score een jaar na de invoering van ART in een door de Universiteit van Witwatersrand geleide mobiele publieke mondgezondheidszorg kliniek (**Hoofdstuk 2**). De toename van de REX-score van het tijdelijk gebit was hoger dan van het blijvende. Volgens de zorgverleners waren deze veranderingen toe te schrijven aan de minder bedreigende aard van ART, waardoor patiënten ART verkiezen boven de conventionele wijze van restaureren. Conventionele restauraties gaan gepaard met invasieve handelingen zoals het toedienen van injecties voor verdoving en het boren in tandweefsel. Patiënten, en zeker kinderen, voelen zich daardoor niet op hun gemak en zijn angstig. Daartegenover creëert de toepassing van ART een meer ontspannen atmosfeer waarbij nauwelijks verdoving hoeft te worden gegeven en waarbij niet geboord hoeft te worden. In de Zuid-Afrikaanse context waar extractie als behandeling van kiespijn eerder regel is dan uitzondering, ondersteunt ART de intentie van de behandelaar om vroegtijdig verlies van een gebitselement te voorkomen. Een mogelijke verklaring voor de hogere REX-score van het tijdelijk gebit dan van het blijvende is het feit dat kinderen in het algemeen angstiger zijn voor injecties en de boor dan volwassenen. In dit proefschrift werd de effectiviteit van de invoering van ART, de toepasbaarheid en de mate waarin een hogere REX-score kan worden verkregen, onderzocht in de Zuid-Afrikaanse publieke mondgezondheidszorg.

Over de toepassing van ART is gemeld dat het minder pijnlijk is (1-5) en dat angst voor de tandarts bij ART minder is dan bij conventionele restauratieve behandeling (6,7). Er is een verband gevonden tussen angst voor de tandarts en stress van de behandelaar (8-14). Weinig tot geen angst voor de tandarts is in verband gebracht met een positieve houding en coöperatief gedrag van de patiënt (15-17) en dit coöperatieve gedrag is geassocieerd met minder stress van de behandelaar (18-20).

Op grond van bovengenoemde associaties werd aangenomen dat tandheelkundige zorgverleners gemotiveerd zouden zijn om ART te kiezen en het vaker toe te passen dan conventionele restauraties als behandeling van pijnlijke elementen waarvan de pulpa niet ontstoken is. Een dergelijke keuze

zou leiden tot een toename van het aantal restauraties en vervolgens tot een hogere REX-score. Figuur 1 toont het conceptuele schema van de verbanden en hypothetische interacties tussen ART behandeling, angst voor de tandarts, stress van de behandelaar en REX-scores in de publieke mondgezondheidszorg. Dit schema wordt vervolgens besproken.

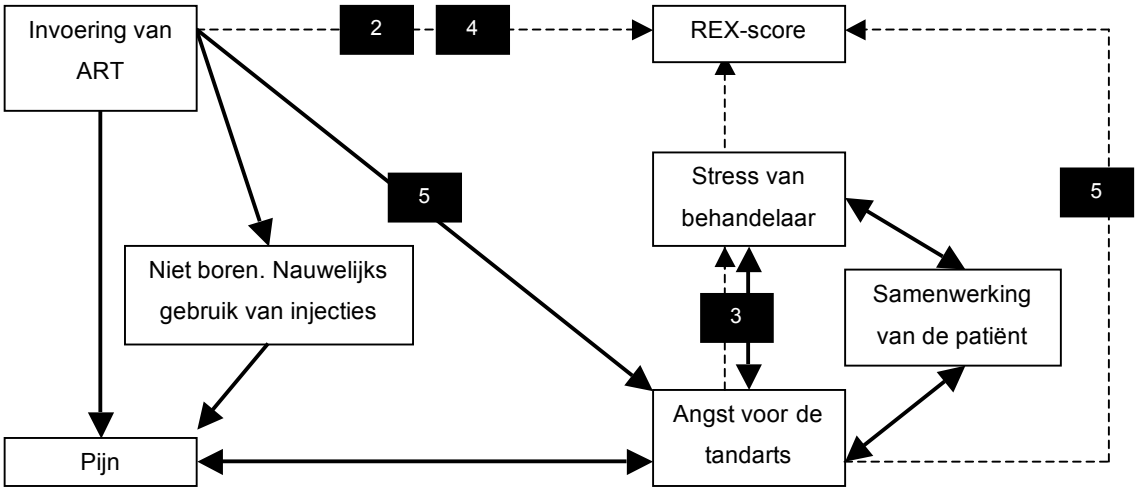

Figure 1. *Conceptueel schema van associaties en hypothetische interacties tussen verschillende componenten*

Associaties tussen componenten op grond van bestaande evidentie;

Causaliteit tussen componenten;

Hypothetische interacties;

Interacties onderzocht in dit proefschrift (per hoofdstuk):

2 *Hoofdstuk2* 3 *Hoofdstuk 3* 4 *Hoofdstuk 4* 5 *Hoofdstuk 5*

Conceptueel schema

Ofschoon er bewijs is voor het bestaan van verbanden tussen sommige componenten van het conceptuele schema, levert de huidige literatuur geen bewijs voor oorzakelijke interacties, noch levert zij bewijs ter ondersteuning van enig verband of oorzakelijke interactie tussen de invoering van ART, stress bij de behandelaar en REX-score in de publieke mondgezondheids-zorg. Er zijn factoren die de hypothetische interacties in de Zuid-Afrikaanse context zouden kunnen beïnvloeden, die discussie behoeven.

Al eerder is vermeld (**Hoofdstuk1**) dat meer dan 80% van de Zuid-Afrikanen afhankelijk is van publieke mondgezondheidszorg. Die publieke zorg wordt geconfronteerd met een lang bestaand gebrek aan hulpbronnen (21-23). De zorg heeft bijvoorbeeld te maken met een tekort aan tandheelkundige zorgverleners. Dit tekort, in combinatie met een toenemend aantal patiënten dat hulp zoekt in overheidsklinieken (24), resulteert in een hoge werklast (22). De meeste patiënten bezoeken de tandheelkundige klinieken om van de pijn af geholpen te worden en vragen om extractie als behandeling. Het is daarom niet onrealistisch de vraag te stellen of de zorgverleners wel genoeg tijd hebben om een nieuwe behandeling als ART in te voeren en toe te passen en daarmee het aantal restauraties te verhogen in relatie tot extracties. Het feit dat Zwarte Afrikanen, die van oudsher liever een extractie dan een restauratie willen (26) en verreweg de meerderheid vormen onder de patiënten (25), maakt het verhogen van de REX-score minder vanzelfsprekend. Bovendien weten deze patiënten mogelijk niet dat pijn behandeld kan worden door middel van een restauratie en komen daarom niet voor een vulling. Hoewel ART minder pijnlijk is dan de conventionele restauratieve behandeling, kunnen de bovengenoemde factoren belemmerend werken op een stijging van de REX-score waar het de verschuiving betreft van extractie naar restauratie, zoals gevonden in de mobiele publieke mondgezondheidszorg kliniek (**Hoofdstuk 2**).

In de ogen van de zorgverlener kan angst voor de tandarts misschien niet altijd beschouwd worden als de voornaamste oorzaak van stress die ze ervaren als ze restauratief behandelen in de publieke zorg. Eerder misschien is het tekort aan hulpmiddelen, zoals instrumenten en vulmaterialen nodig voor ART, een belemmerende factor als het gaat om het toepassen van ART,

zelfs waar ART heeft geleid tot vermindering van stress. De invloed van deze mogelijk belemmerende factoren is beschreven in **Hoofdstuk 6**.

Uitkomsten van het onderzoek

Dit promotieonderzoek was de eerste poging om de effecten te onderzoeken van de invoering van ART in de (Zuid-Afrikaanse) publieke mondgezondheidszorg. De uitkomsten van het onderzoek belichten een aantal hypothetische associaties die weergegeven zijn in het conceptuele schema. Deze uitkomsten worden hieronder genoemd.

1. De REX-score is gestegen na de invoering van ART in een door de universiteit geleide mobiele publieke mondgezondheidszorg kliniek (**Hoofdstuk 2**), maar er is geen stijging geconstateerd nadat ART was ingevoerd in het publieke mondgezondheidszorg stelsel (**Hoofdstuk 4**);
2. Sommige zorgverleners behandelden vaker met ART, vooral bij kinderen (**Hoofdstuk 4**);
3. Er is een aanwijzing dat extractie en angst voor de tandarts verband houden met stress bij de zorgverlener (**Hoofdstuk 3**) en dat ART geassocieerd wordt met minder angst voor de tandarts (**Hoofdstuk 5**).

Kwaliteit van het onderzoek

Gezien de complexiteit van het onderzoek naar de invoering van een nieuwe behandelingsmethode (ART) in een bestaand zorgstelsel, wordt de kwaliteit van de onderzoeksmethodologie hoofdstuk voor hoofdstuk besproken op de volgende bladzijden.

Hoofdstuk 2

In dit hoofdstuk is het effect beschreven van de invoering van ART in een door de universiteit geleide mobiele kliniek waar de omstandigheden min of meer constant waren.

De beperking in de studieopzet was het ontbreken van een controlegroep. Het ontbreken hiervan maakte het moeilijk om te beoordelen of de gevonden stijging van de REX-score inderdaad toe te schrijven was aan de invoering van ART en niet aan de ‘driving force’ van de zorgverleners om meer restauraties te maken in het kader van de onderzoeksdoelstelling.

Derhalve moet de interne validiteit van dit onderzoek als laag worden beschouwd. Hier wordt wel benadrukt dat het gaat om een onderzoek met een oriënterend karakter: inzicht verkrijgen of ART hoe dan ook geaccepteerd zou worden door zorgverleners en de patiënten. De constatering dat ART inderdaad werd geaccepteerd, rechtvaardigde verder onderzoek. Achteraf gezien zou het een betere optie zijn geweest het onderzoek eerst te richten op deze interne validiteit dan om te beginnen aan verder onderzoek naar de toepasbaarheid van ART in het Zuid-Afrikaanse publieke gezondheidszorg stelsel.

Hoofdstuk 3

In dit hoofdstuk is de stress van behandelaars gemeten aan de hand van een vragenlijst met voorgeselecteerde stressfactoren (8,27), afkomstig van een bestaande gevalideerde vragenlijst gebruikt in particuliere praktijken in Zuid-Afrika (27). Stressfactoren die niet relevant waren voor de publieke gezondheidszorg sector zijn uit de oorspronkelijke vragenlijst verwijderd, zoals factoren gerelateerd aan de garantie van voldoende inkomsten en de daarbij behorende praktijkomvang, en de afspraaktrouw van patiënten. Men kan aanvoeren dat de validiteit van de gebruikte vragenlijst in het huidige onderzoek onvoldoende gewaarborgd was, maar aan de andere kant, waren de opgenomen stressfactoren uiterst relevant voor de omstandigheden in de publieke mondgezondheidszorg.

Gesloten vragen zijn eerder gebruikt in onderzoek naar stress bij zorgverleners (11). Dat heeft echter het nadeel dat een ruimer aantal factoren die mogelijk stress induceren buiten beschouwing worden gelaten. Het zou te verkiezen zijn geweest als er gebruik gemaakt was van een reeds algemeen toegepaste vragenlijst die ook relevant was voor de vaststelling van stressfactoren in de Zuid-Afrikaanse publieke mondgezondheidszorg, maar een dergelijke vragenlijst was niet voorhanden. Resultaten van onderzoek naar stress in de literatuur zijn verkregen uit settings die verschillen van die in de Zuid-Afrikaanse mondgezondheidszorg.

Wat volgens de zorgverleners de meeste stress veroorzaakte, waren angst voor de tandarts en werklast. Aangezien angst voor de tandarts niet is onderzocht, is er alleen een positief verband gevonden tussen het

stressniveau en het aantal behandelde patiënten en het aantal extracties per dag. Dit betekent dat de uitkomsten van de vragenlijst naar door zorgverleners ondervonden stress slechts ten dele gevalideerd konden worden.

Hoofdstuk 4

In dit hoofdstuk is het effect van de invoering van ART in de Zuid-Afrikaanse publieke mondgezondheidszorg beschreven. De resultaten tonen aan dat de introductie van ART een verschuiving teweegbracht in het behandelingspatroon van de zorgverlener**:** van conventionele restauraties naar ART, met name in de melkgebitjes. Deze verschuiving was echter minder uitgesproken dan die naar voren gekomen in de voorstudie. Bij de voorstudie was slechts een kleine niet gerandomiseerde groep zorgverleners betrokken, wat mogelijk heeft geleid tot een selectie bias van enthousiaste gebruikers van ART (28). Andere verstorende factoren, zoals verschillen in milieuomstandigheden van de bezochte gemeenschappen, kunnen een rol hebben gespeeld, hoewel deze gemeenschappen dezelfde laag sociaal-economische achtergrond hadden. Deze factoren hebben mogelijk geleid tot verschillende indicaties en verschillende behandelingswensen van de patiënt. Omstandigheden in de publieke mondgezondheidszorg klinieken, zoals werklast, organisatiewijze van de dienstverlening, bevoorrading van materialen, vaardigheden in klinische ART en stoelassistentie waren niet geheel vergelijkbaar met de omstandigheden in de door de universiteit geleide mobiele kliniek van het vooronderzoek. De genoemde factoren zijn waarschijnlijk verantwoordelijk voor de beperkte externe validiteit van de uitkomsten van de voorstudie.

In tegenstelling tot bij het vooronderzoek (**Hoofdstuk 2**) resulteerde de verschuiving van conventionele restauraties naar ART in de publieke mondgezondheidszorg niet in hogere REX-scores. De enigszins verschillende omstandigheden waaronder beide studies werden uitgevoerd en de eerder genoemde beperkte interne validiteit van de voorstudie verklaren waarom de uitkomsten van de voorstudie niet zijn te extrapoleren naar de publieke mondgezondheidszorg.

Hoofdstuk 5

Enkele moeilijkheden bij het uitvoeren van onderzoek naar het verband tussen ART en angst voor de tandarts in de setting van de publieke mondgezondheidszorg zijn beschreven in de desbetreffende publicatie. Een methodologisch aspect dat weinig aandacht heeft gekregen, wordt hier nader besproken.

De invloed van ART op angst voor de tandarts zou idealiter vastgesteld moeten worden door middel van een pre-test en een post-test. Er werd echter alleen een post-test gedaan. Gevalideerde meetschalen voor angst zoals de DAS en CFSS-SF, zijn ontworpen om aan behandeling gerelateerde vrees te meten (29). Vrees voor invasieve tandheelkundige behandelingen zoals boren in tandweefsel, zijn in verband gebracht met angst voor de tandarts (6,7). Om de hoogste validiteit te verkrijgen bij het vaststellen van angst voor de tandarts zouden gevalideerde meetschalen voor angst onmiddellijk na behandeling moeten worden gebruikt (30) en niet ervoor. Patiënten kunnen anticiperende angst ervaren, hetgeen de vrees voor een specifieke tandheelkundige behandeling kan maskeren (29). Om een gevalideerde pre-test te doen in dit onderzoek dient de vrees voor een conventionele restauratieve behandeling zowel in de controlegroep als in de proefgroep te worden vastgesteld. Vervolgens zou bij een tweede bezoek een aantal dagen later de vrees voor restauratieve behandeling, conventioneel dan wel ART, opnieuw moeten worden vastgesteld. Het probleem in de Zuid-Afrikaanse publieke mondgezondheidszorg is dat slechts weinig patiënten de kliniek bezoeken voor restauratieve behandeling. Dit bleek ook weer in het huidige onderzoek waar slecht vijf zorgverleners in de ART groep restauraties legden op de dag dat het angstonderzoek moest worden uitgevoerd. Pogingen om patiënten in Afrika terug te laten komen voor een restauratieve behandeling mislukken meestal, omdat patiënten de afspraak niet nakomen (31). De speciale omstandigheden waarin dit onderzoek plaatsvond, verhinderden vervolgbezoek van de patiënt en daarmee de mogelijkheid voor een pre-test.

Er is een uitgesproken verschil in de mate van angst voor de tandarts tussen de ART-groep en de conventioneel behandelde groep. Het is hoogst waarschijnlijk dat bijna alle patiënten in beide onderzoeksgroepen voor het eerst een vulling kregen. Je zou daarom kunnen stellen dat onder de gegeven

omstandigheden van de Zuid-Afrikaanse setting, het ontbreken van een pre-test van minder belang is dan in settings waar patiënten allerlei tandheelkundige behandelingen hebben ondergaan.

Hoofdstuk 6

Factoren die een soepele invoering van ART in de Zuid-Afrikaanse publieke mondgezondheidszorg kunnen verhinderen, zijn beschreven in dit hoofdstuk. De resultaten werden verkregen door middel van een enkele vragenlijst waarin de mening van zorgverleners aangaande een aantal potentiële belemmerende factoren werd vastgesteld. Deze zijn echter niet geverifieerd aan de hand van relevante gegevens waarover men in de mondgezondheidszorg beschikt. Het voorhanden zijn van voldoende instrumenten en materialen om ART-behandelingen te geven bijvoorbeeld, kan simpel nagegaan worden door een inventarisatie en door beschikbare administratieve gegevens te raadplegen. Een dergelijke controle zou de kwaliteit van de verkregen gegevens verbeterd hebben.

De uitkomst van dit verkennend onderzoek naar belemmerende factoren is voor velerlei uitleg vatbaar, gezien er niet één belemmerende factor noch een combinatie van factoren een bevredigende verklaring kan bieden voor het relatief lage aantal ART-behandelingen en de onveranderlijk lage REX-score. De conclusie luidt daarom dat de beschreven belemmerende factoren en mogelijk andere buiten beschouwing gebleven factoren zoals lage salarissen, het ontbreken van een stimulans om meer restauratieve behandelingen uit te voeren waaronder ART, onbekendheid bij patiënten dat restauraties ook tot de mogelijkheden behoren en geringe mogelijkheden tot beroepsmatige ontwikkeling, allemaal een rol gespeeld hebben in het complexe samenspel dat de restauratieve zorg belemmerd heeft. Uitvoeriger onderzoek op dit gebied is noodzakelijk. Dit rechtvaardigt diepte-interviews met (9,10) met de zorgverleners en de verantwoordelijke beleidsmakers over door zorgverleners ervaren stress (32), voldoening in het werk (33) en factoren die de werkomstandigheden en de zorgverlening zouden kunnen verbeteren. Een dergelijk kwalitatief onderzoek zou meer inzicht kunnen verschaffen in hoe beleidsmakers en zorgverleners denken over de huidige publieke mondgezondheidszorg en de werkomstandigheden, zoals het ook de

basis zou kunnen leggen voor de juiste keuzes bij het invoeren van veranderingen.

Onderzoek in de Afrikaanse publieke gezondheidszorg – een dilemma

Gerandomiseerd gecontroleerd opgezet onderzoek is de 'gouden standaard' geworden in research (34). Maar uitvoering van dergelijk hoogwaardig onderzoek is door logistieke problemen vaak onmogelijk en onbetaalbaar door gebrek aan financiële middelen (35). Om dan maar af te wachten tot hoogwaardig onderzoek steunend op toereikende hulpbronnen evidence-based antwoorden geeft, is als onethisch te beschouwen (35). Er is aangevoerd dat gerandomiseerd gecontroleerd onderzoek vragen in het zorgstelsel aangaande effectiviteit en efficiëntie van klinische interventies niet adequaat kan beantwoorden (34), vanwege problemen van toepasbaarheid en werkzaamheid onder specifieke omstandigheden. Het onderzoek dat ten grondslag ligt aan dit proefschrift moet in dat licht beschouwd worden.

Conclusie

De conclusie op grond van de bevindingen van dit promotieonderzoek luidt dat een gedegen analyse van de situatie ter plaatse vooraf zou moeten gaan aan de invoering van ART in de publieke mondgezondheidszorg, met name in zorgstelsels met een voortdurend gebrek aan hulpbronnen. Als zo'n analyse factoren aan het licht brengt die een verhoging van het aantal restauratieve behandelingen kunnen belemmeren en dit probleem is niet op te lossen, dan is het onwaarschijnlijk dat ART zal leiden tot optimale resultaten.

Dit proefschrift toont aan dat een eenmalige driedaagse ART-cursus, toestemming van de overheid om veranderingen door te voeren in het zorgstelsel en aanwezigheid van noodzakelijke instrumenten en materialen voor ART op zich onvoldoende voorwaarden zijn voor een effectieve invoering van ART in de Zuid-Afrikaanse mondgezondheidszorg.

Kakaretso, puisano e Akaretsang le Sephetho (in Sesotho)

Kakaretso

Pele ho 1994, baahi ba bangata ba Afrika Borwa ba ne ba fumana tlhokomelo e fokolang haholo ya meno ya tshireletso ya meno le kalafo. Lebaka le leholo la ho etela ngaka ya meno e ne e le ho ya ntsha leino ka tsela e utlwisang bohloko. Ka mora ho fedisa molao wa kgethollo ya batho ka mmala, molao wa phumano e lekanang ya ditshebeletso tsa bophelo tsa tlhokomelo ya meno bakeng sa baahi bohle ba Afrika Borwa o ile wa kengwa tshebetsong. Leha ho le jwalo, tsamaisong ya hona jwale ya ditshebeletso tsa bophelo tsa setjhaba tsa tlhokomelo ya meno, ho bolokwa ha leino ha ho bapiswa le ho ntshwa ha leino ho hlaloswa e le leino le le leng le bolokwang mme a robong a ntshuwale hoja ho na le thepa ya meno ya kalafo e tlwaelehileng ya ho boloka leino. Leha ho le jwalo, ho latela Phuputso ya Naha ya Tlhokomelo ya Meno (*National Oral Health Survey*) ya 1988/9, tlhoko ya hore meno a bolokwe e ne e phahameng ka makgetlo a mane palong ya batho ba batlang ho ntsha meno. Ho se tshwane hona jwalo pakeng ditshebeletsong tsa bophelo, hara mabaka a mang, ho hlaloswa e le leqeme la dingaka tsa meno le basebetsi ba di thusang ditshebeletsong tsa setjhaba, e leng seo ho hlakileng hore se feletse ka mosebetsi o mongata.

Ho tloha ha ho hatiswa Phuputso ya Naha ya Tlhokomelo ya Meno (*National Oral Health Survey*), Lefapha la Bophelo le ipehetse dipakane tsa bophelo tsa tlhokomelo ya meno tseo le batlang ho di finyella ka 2010. Tsona di akarelletsa: ho eketsa mehaho ya bophelo e fanang ka ditshebeletso tsa tlhokomelo ya meno a bana; ho eketsa diphesente tsa bana ba dilemo di 6 ba meno a sa bolang ka 50%; ho fokotsa palo-kakaretso ya DMFT ho ba dilemo di 12 ho ya ho 1.0. Ho phaella moo, Lefapha la Bophelo le radile maano ho tiisa ditshebeletso tsa motheo tsa ho phekola ka ho etsa bonnete ba hore ditleliniki tsohle di fana ka lenaneo la tlhokomelo ya meno. Lenaneo lena le akarelletsa ditshebeletso tsa motheo tsa kalafo, le akarelletsa tlhahlobo ya meno, ho nka ditshwantso tsa meno tsa x-*ray*, ho hlwekisa meno, ho fana ka thuso maemong a tshohanyetso ka ho kokobetsa bohloko le ho ruruhana le ho le kata ho bonolo (ha karolo ya leino ya 1-3). Ho sisinngwa kalafo ena e bitswang Atraumatic Restorative Treatment (ART) e sebediswe bakeng

tlhokomelo e hlokahalang ya ho sireletsa leino le ho le boloka ka ho tlatsa. Kalafo ena ya ART e ile ya thakgolwa hara naha ka 1996 mme ya amohelwa ke baemedi ba dikolo tsohle tsa kalafo ya meno ka hara naha e le mokgwa o ka fihlellwang wa kalafo. Leha ho le jwalo, kaha ho ne ho se na lesedi leha e le lefe la ho sebedisa ART ditsamaisong tsa setjhaba tsa tlhokomelo ya meno, ho ile ha hlokahala tekolo ya tshwaetso ya kalafo ena. Patlisiso ena ya PhD e reretswe ho fuputsa hore na ART e na le tshawetse efe mabapi le tlhokomelo ya ho boloka meno le ho ntshuwa ha meno ditshebeletsong tsa tlhokomelo ya meno diprofinseng tsa setjhaba tsa Afrika Borwa.

E le hore ho ka batlisiswa ka botlalo mabaka a susumetsang mokgwa o teng kajeno wa ho fana ka ditshebeletso tsa tlhokomelo ya meno, ho ile ha bokellwa lesedi le mabapi le maikutlo a dingaka tsa meno le maemo ao di sebetsang tlasa wona le tlhokomelo ya ho boloka meno e fanwang diprofinseng tsa setjhaba ya ditshebeletso tsa meno. Patlisiso ena e ile ya etswa Profinseng ya Gauteng, leboya le ka botjhabela la Afrika Borwa. Ka 2001, dingaka tsa meno tse mashome a mane a motso o mong di ile tsa nka karolo ho tswa dibakeng tse tharo ho tse hlano tsa profinse. Foromo ya dipotso e hlophisitsweng e ile ya sebediswa e le hore di fane ka lesedi mabapi le palo ya bakudi ba neng ba alashwa ka letsatsi, tekanyo ya kgatello ya bona ya maikutlo e bakwang ke mosebetsi le maikutlo a bona ka mabaka a ka sehloohong a neng a ba bakela kgatello ya maikutlo ka mosebetsi wa letsatsi. Diphetho di ile tsa bontsha hore palo-kakaretso ya bakudi ba alafuwang ka letsatsi ke ngaka ka nngwe e ne e le ba 26 (SD = 8.4). Kakaretso ya tekanyo ya kgatello ya maikutlo e amanang le mosebetsi, e lekanngwang ka sekala se qalang ho 1 (ha ho na kgatello ya maikutlo) ho ya ho 10 (kgatello e kgolo ya maikutlo), e bile 4.9 (SD = 1.9). Dingaka tse ngata tsa meno di ne di nka ho tshwenyeha haholo ha bakudi ba meno e le lebaka le leholo le neng le ba bakela kgatello ya maikutlo, le latelwa ke palo e kgolo haholo ya bakudi. Kalafo e ka sehlooho e neng e fanwa ke ho ntsha meno. Kakaretso ya tekanyo ya kgatello ya maikutlo ya ngaka e ne e eketswa ke keketseho ya palo ya bakudi ba alashwang ka letsatsi ($r=0.44$; $p=0.004$), le keketseho ya palo ya bakudi ba ntshuwang meno ka letsatsi ($r=0.41$; $p=0.008$). Ho ile ha fihlellwa qeto ya hore ditshebeletso tsa tlhokomelo ya ho boloka ka ho meno le ditshebeletsong tsa setjhaba di ne di haella haella le hore ho ntsha meno e

ne e le kalafo e ka sehloohong e neng e fanwa. Palo e kgolo ya bakudi le ho tshwenyeha haholo ha bakudi ba meno e ne e baka boemo bona. Ho ile ha ntshwa ditshisinyo tsa hore ba boholong lefapheng la bophelo ba tshwanetse ho nka mehato e loketseng e le hore ho sebetsanwe le boemo bona ka mokgwa o loketseng.

Ha ho shejwa boemo bo ka hodimo, ba boholong lefapheng la bophelo Gauteng ba nahana hore ka ho kenaya mofuta ona wa kalafo Atraumatic Restorative Treatment (ART) tsamaisong ya tlhokomelo ya bophelo ho ne ho tla fana ka tharollo leqemeng lena la ditshebeletso tsa tlhokomelo ya molomo. ART e sebedisa disebediswa tsa letsoho bakeng sa ho laola masoba a menong a bodileng mme ho bonahetse e sa tshose jwaloka mekgwa e tlwaelehileng e sebediswang. E le hore ho hlahlojwe diphihlello tsa ART tlhokomelong ya meno ho a boloka, patlisiso ya teko e ile ya etswa tlasa maemo a hlophisitsweng sekolong a Tsamaiso ya Tlhokomelo ya Meno e Etsetswang ka Koloing (*Mobile Dental System*) - MDS. Ho tloha ka 1985, lefapha la Division of Public Oral Health la Univesithi ya Witwatersrand, Johannesburg, le ile la tsamaisa MDS dibakeng tsa batho ba dikobo-di-mahetleng ho potoloha Johannesburg. Ho ile ha alashwa meno, ho sebediswa Yuniti ya Koloi ya Meno (*Mobile Dental Unit*) (MDU) e nang le ditleliniki tse nne tsa meno tse nang le thepa e nngwe le e nngwe ya meno, mme e ne e sebediswa ke sehlopha sa dingaka tsa meno tse tharo, bathusi ba ngaka ya meno le moifo. Ka 1996, dingaka tsohle tsa meno di ile tsa kwetlisetswa ho sebedisa ART mme tsa tswela pele ho sebedisa mokgwa ona hammoho le mekgwa e meng ya ho boloka. Selemong se latelang, ART e ile ya nkwa e le mokgwa o ka sehloohong wa kalafo ya ho boloka ka ho tlatsa meno. Ho ile ha bolokwa ditlaleho toshle tsa tlhokomelo ya meno e ileng ya etswa ditlaleho tsa mekgwa yohle ya ho sebetsa meno e ileng e sebediswa pakeng tsa 1995 le 1997. Ho ile ha lemohuwa dinako tse tharo tsa pokello ya lesedi la selemo: Pele ART e sebediswa - 1996 (A); Nako ya ho amohela butle-butle ART - 1997 (B) le ho kenyelletswa ho feletseng ha ART - 1998 (C).

Dingaka di ne di lokolohile ho kgetha kalafo ya tsona le tshebediso ya thepa ya ho hlokomela meno. Ho bapisa tlaleho ya kalafo nakong ya A le ya C ho ile ha fuputsa katleho ya ART ka ho sebedisa koloi ya tlhokomelo ya meno. Foromo ya dipotso e nang le dintlha tse hlano e ile ya sebediswa

bakeng sa puisano le dingaka tsa meno, bakeng sa ho lekola mabaka a ho fetola tsela ya kalafo. Dipotso di ne di amana le bolelele ba nako eo ka yona ba sebeleditseng ka hara MDU, dikgetho tsa bona ka bomong ha ba sebetsa meno a bana le a batho ba baholo le mabaka a bona a ho kgetha mekgwa e itseng ya kalafo. Kakaretso ya meno a bolokilweng / a ntshitsweng (REX) e ile ya nyoloha ho tloha ho 0.37 nakong ya A ho ya ho 1.15 nakong ya C. Sena se etsahetse ka lebaka la ho fokotseha ha dipheresente tsa ho ntshwa ha meno le ho nyoloha ha dipheresente tsa ho bolokwa ha meno ditshebetsong tseo ka bobedi tsa meno ($p < 0.0001$). Nakong ya C, ART e ne e le mokgwa o ka sehloohong o sebediswang wa kalafo (45.4%) le ditekanyo tsa tshebediso ya ART bakeng sa tlhokomelo ya meno ka ho a boloka e 98.2%. Mekgwa e tlwaelehileng ya kalafo ya tlhokomelo ya meno ka ho a boloka e ile ya fokotseha ho tloha ho 100% ho ya ho 1.8%. Phetoho ena e ile ya amahanngwa le hore dingaka tsa meno di ile tsa fetola mekgwa ya kalafo ka lebaka la ho rata ART. Bohle ba ileng ba araba ba ile ba bontsha hore mokgwa wa ho boloka leino ka ho le ha tlhokomelo ya meno ka ho a boloka wa ART ke kgetho ya bona hona jwale bakeng sa ho alafa mohlahare o le mong le e mengata e nang le mekoti ka lebaka la ho bola. Mabaka a mang a laolang kgetho ena a akarelletsa thepa e ntlafaditsweng ya *glass-ionomer cements* le hore ha ho hlokahale hore motho a bolawe sebaka seo ho sebetswang leino ho sona, ka hobane ho tlatsa dikoti menong ka ART ho ne ho se bohloko hakaalo.

Ho ipapisitswe le diphetho tsena tse kgothatsang, ho ile ha qalwa patlisiso ka morero wa ho lekola diphetho tsa thupelo e le nngwe ya ART ya matsatsi a 3 e neng e bua ka mokgwa wa kalafo o sebediswang ke dingaka tsa meno tse tsamaisong ya ditshebeletso tsa setjhaba tsa meno tsa lebatowa ka mora nako ya dikgwedi tse 12. Sehlopha sa dipatlisiso, se nang le dingaka tsa meno tse 21 tse tswang lebatoweng la Ekurhuleni Profinseng ya Gauteng, se ile sa kwetlisetswa ho sebedisa ART, ho latela maemo a sisintsweng. Sehlopha se laolwang se ne se na le dingaka tsa meno tse 20 tse tswang mabatoweng a 2 a profinse ena. Ditlaleho tsa tleliniki tse nang le palo ya meno a bolokilweng le palo ya meno a ntshitsweng le mekgwa ya ho tlatsa meno e sebedisitsweng nako le nako ha ho sebetswa meno di ile tsa bokellwa dikgwedi tse 4 pejana, le dikgwedi tse 12 ka mora thupello ya ART ya

sehlopha sa patlisiso, le ka nako e tshwanang sehlopheng se laolwang. Phapang pakeng tsa meno bolokilweng / ntshitsweng (REX) pele le ka mora thupello ya ART e ile ya bapiswa pakeng tsa ditlaleho tsa sehlopha sa dipatlisiso le sehlopha se laolwang. Ha ho na phapang e ileng ya hlokomelwa mabapi le ho eketseha ha dintlha tsa REX ka kakaretso ha ho sebetsanwa le meno a bana sehlopheng sa dipatlisiso (0.06; SD = 0.17) le sehlopheng se laolwang (0.03; SD = 0.34). Ha ho sebetswa meno a batho ba moholo, ka kakaretso dimaraka tsa REX di ile tsa eketseha sehlopheng sa tlhahlobo le se laolang e ne e le 0.03 (SD=0.16) le 0.01 (SD = 0.09). Dipheresente tsa ART tsa palo-kakaretso ya meno a bana a tlatsitsweng le a batho ba baholo e bile 67% le 11%, nakong e fetang dikgwedi tse 12 ka mora nako ya thupello ya ART. Patlisiso ena e ile ya bontsha hore thupello e le nngwe ya ART ha e ya fetola mokgwa wa ho tlatsa meno ho a boloka ka kakaretso le wa ho a ntsha o sebediswang ke dingaka tsa meno ditshebeletsong tsa lebatowa tsa setjhaba ka mora dikgwedi tse 12.

Mabaka a hore dingaka tsa meno di fetole mekgwa ya kalafo ka mora ho kenyeletsa ART tsamaisong ya tlhokomelo ya bohlweki ba molomo a ile a hlahlojwa ho ya pele. Dikgakanyo tsena tse pedi di ile tsa hlahlojwa: 1) Ho sebedisa ART ho etsa hore bakudi ba se ke ba tshwenyeha haholo le 2) ho fella ka dintlha tse hodimo tsa REX. Sehlopha sa dipatlisiso se ne se na le dingaka tsa meno tse 9 tse neng di kwetliseditswe ho sebedisa ART, ho fapana le dingaka tsa meno tsa sehlopha se laolwang (n =11) tse neng di sa kwetlisetswa ho sebedisa ART le tse sa e sebedisang. *Children's Fear Survey Schedule/Short Form* (CFSS-SF) le Sekala sa CORAH sa ho Tshaba Tshebetso ya Meno (*Dental Anxiety Scale*) (DAS) di ile tsa sebedisetswa ho lekola ho tshoha ha mokudi ka mora kalafo ya ho boloka leino ka ho le tlatsa leino ho sebediswa ART (sehlopha sa dipatlisiso) le ho sebedisa mokgwa o tlwaelehileng (sehlopha se laolwang). Dintlha tsa REX bakeng sa meno a lebese (a bana) le meno a tiileng (a batho ba baholo) tsa ngaka ka nngwe di ile tsa balwa bakeng sa dihlopha ka bobedi tsa patlisiso, ho sebediswa dipalo-palo tse bokeletsweng dikgweding tse 12 tsa ka mora thupello ya ART. Kakaretso ya dintlha tsa CFSS-SF bakeng sa sehlopha sa dipatlisiso sa bana e ne e kgahlisa ho ya ka dipalo-palo (p=0.001): e le tlase (14.8: SE = 1.7) ho feta ya sehlopha se laolwang (24.4: SE = 1.2). Kakaretso ya dimaraka tsa

DAS tsa sehlopha sa tlhahlobo sa batho ba baholo (6.7: SE = 0.4) e ne e thahasellisa ho ya ka dipalo-palo (p=0.0005) e le ka tlaase ho ya sehlopha se laolwang (9.3: SE= 0.2). Ha ho kamano e kgolo ya dipalo-palo e ileng ya hlokomelwa pakeng tsa ho tshoha kalafo ya meno le karolelano ya REX ya ngaka ka nngwe bakeng sa dihlopha ka bobedi. Ho ne ho se na phapang kakaretsong ya dintlha tsa REX pakeng tsa sehlopha sa dipatlisiso le se laolwang. Kgakanyo ya pele e ile ya nkwa e nepahetse mme ya bobedi ya qhelelwa ka thoko. Le hoja dintlha tsa ho se tshohe haholo di ne di le tlase ho bakudi ba bana le ba batho ba baholo ba ileng ba sebetswa ka ART ho feta tsa mokgwa o tlwaelehileng wa ho tlatsa leino ha le alafuwa, diphello tsena tse ntle ha dia ka tsa etsa hore dintlha tsa REX di nyolohe.

Mabaka a tshitiso ya ho fetola ha dingaka tsa meno mekgwa ya tsona ya kalafo ka mora ho kenyelletsa ART a ile a fuputswa ho ya pele. Mabaka a supileng a amanang le ho fana ka ditshebeletso a ile a lemohuwa, motheong wa hore a ka nna a ba le tshusumetso e sitisang (kapa phello e sitisang) tshebetso ya ART ya dingaka tsa meno tse ditshebeletsong tsa setjhaba tsa bophelo lebatoweng la Ekurhuleni Profinseng ya Gauteng. Mabaka ana ke a latelang: *palo e sekgahla ya bakudi / bongata ba mosebetsi; maikutlo a ngaka ya meno; maikutlo a mokudi; tsamaiso ya ditshebeletso tsa tlhokomelo ya bohlweki ba molomo; boteng ba thepa; tsebo ya bongaka ya ART; bathusi*.

E le hore ho lekolwe ditshitiso tse lemohilweng, ho ile ha etswa foromo ya dipotso tse 30 le ho leka lenaneo. Dingaka di ile tsa kopjwa hore di tlatse dipotso tseo ho latela sekala sa *5-point Lickert*. Diforomo tseo tsa dipotso di ile tsa behwa leihlo le ho bokellwa ke mosebetsi ya kwetliseditsweng selemo se le seng ka mora thupello ya ART. E le ho hlahlojwe matla a tshitiso ka nngwe, dikarabo di ile tsa lekanngwa ka sekala se qalang ka 1= ha ho na tshitiso ho ya ho 5 = tshitiso e kgolo haholo. Bakeng sa ngaka ka nngwe, ditlaleho tsa kalafo ya meno; tse akaretsang palo ya meno a ntshitsweng le a tlatsitsweng ka mokgwa o tlwaelehileng le ka mokgwa wa ART bakeng sa kalafo ya meno a bana le a batho baholo, di ile tsa bokellwa nakong e fetang selemo ka mora ho qeta thupello ya ART. Ho sebediswa dipalo-palo tse bokeletsweng, dintlha tsa REX le diphesente tsa ART tsa kakaretso ya meno a ileng a tlatswa di ile tsa balwa mme tsa bapiswa le ditshitiso ka ho fapana ha tsona. Ditshitiso ka botsona di ile tsa bapiswa. Dingaka tsa meno di ile tsa

beha tshitiso ya *palo e sekgahla ya bakudimosebetsi ka hodimo* kakaretso = 2.80; SE = 0.16), le tsebo *ya bongaka ya ART* tlase haholo (kakaretso = 0.47; SE = 0.14). Selemong sa pele ka mora thupello ya ART, kgaello ya *thepa ya meno* e ne e le tshitiso tabeng ya ho fana ka tshebeletso ya tlhokomelo ya ho tlatsa leino ha e bapiswa le ya ho ntsha leino ka bobedi ho bakudi ba batho ba baholo le ba bana. Maikutlo a dingaka tsa meno ke hore *tsebo e* fokolang *ya bongaka ya ART* e ne e le tshitiso ya ho sebedisa ART baneng mme *palo e sekgahla ya bakudi, maikutlo a fosahetseng a dingaka le maikutlo a mokudi, kgaello ya ditshebeletso tsa tlhokomelo ya bohlweki ba molomo e bakwang ke ba boholong ditabeng tsa bophelo le kgaello ya bathusi* e bile mabaka a sitisang tshebetso e nepahetseng ya ART hara batho ba baholo tshebeletsong ya tlhokomelo ya setjhaba ya meno lebatoweng la Ekurhuleni dikgweding tse 12 ka mora thupello.

Puisano e akaretsang le sephetho

Diphetho tsa patlisiso ena di bontsha hore le hoja tsebo ya bongaka ya ART e thusa ho theola ho tshoha ha bakudi, sena ha se a fa dingaka tsa meno lebaka le lekaneng le ba susumelletsang hore ba fetole mekgwa eo ba e sebedisang hona jwale ya kalafo tsamaisong ya tshebeletso ya tlhokomelo ya meno setjhabeng Gauteng. Ka mora ho qeta thupello ya matsatsi a 3, dingaka tse etsang tshebeletso ya setjhaba ya tlhokomelo ya meno e hlahlobilweng hase hakaalo hore di etsa ditshebeletso tse ngata tsa ho tlatsa meno ho feta palo ya meno a ntshuwang. Kakaretso ya dintlha tsa REX e bontshitse seo ka ho hlakileng haholo. E ne e le tlase haholo sehlopheng sa dipatlisiso sa dingaka tsa meno ditshebeletsong tsa tlhokomelo ya meno ya setjhaba ho feta ya ditshebeletso tsa tlhokomelo ya meno e ya koloi. Ho hlakile hore ho ne ho na le diphapang pakeng tsa mefuta ena e mmedi ya ditshebeletso. Kameho e le nngwe ya sehlooho ya maemo ao ditshebeletso tsena di etswang tlasa ona. Lenaneo la teko le ile la etswa tlasa maemo a sekolo a neng a le siyo lefapheng la setjhaba la bophelo. Morero wa ditshebeletso tsa meno tse tsamaiswang ka koloi ke ho bontsha theknoloji ya morao-rao e loketseng le mekgwa ya ho fana ka tlhokomelo ya bophelo bo ditabeng tsa meno le ho lekola katleho ya wona. Ho finyella sepheo sena, tsebo e ntle ya bongaka, botsebi le tshusumetso e matla ya mekgwa e metjha ya tlhokomelo

ya bophelo, e kang ART, ke dintho tse hlokahalang ho bongaka lea bolaodi. Ka mabaka ana, ditshitiso tse hlokometsweng mafapheng a setjhaba, e leng *maikutlo a fosahetseng a ngaka, tsebo e haellang ya ART bongaka, kgaello ya bathusi le ditshebeletso*, di ne di le siyo. Ho feta moo, ha ho mohla ba ditshebeletso tsa tlhokomelo ya meno tse tsamayang ka koloi ba kileng ba haella ka *thepa le disebediswa* tsa ART empa dingaka tsa meno ha dia tlaleha *maikutlo a fosahetseng a bakudi* kapa *palo e sekgahla ya bakudi / bongata ba mosebetsi*. Kaha ditshitiso tsena di ne di le siyo, ART e ne e sebediswa ka ho feletseng, jwalokaha ho bontshitswe ke dintlha tsa REX le tshebediso e eketsehileng ya kalafo ya ho tlatsa leino qetellong ya nako ya patlisiso.

Ho ne ho fapane Profinsing ya Gauteng. Thupello e le nngwe ya ART ya matsatsi a 3 ha e ya ntlafatsa lenane la tlhokomelo ya ho tlatsa meno. Leha ho le jwalo, dingaka tse ding tsa meno di ile tsa fetola boikutlo ba tsona ka kalafo ya tlhokomelo ya ho tlatsa meno, ba itihela ka setotswana haholo tlhokomelong ena ya meno ho feta pele ka mora thupello ya ART. Ho sa tsotellehe diphihlello tsena tse nyenyane, ho bonahala ho tswa patlisisong ena ya PhD hore palo ya basebetsi ba menong ba sebedisang mokgwa ona ditshebeletsong tsa setjhaba tsa tlhokomelo ya meno e lokela ho eketseha e le hore ditshebeletso tsena di ntlafale. Maemo ha a hloke ho qalwa fatshe, esita le mehaho ya ditleliniki tsa meno ha e hloke ho hahuwa ka bongata. Leha ho le jwalo, Profinseng ya Gauteng ho na le tlhokahalo e kgolo ya ditjhelete tse lokelang ho lebiswa ditshebeletsong tsa tlhokomelo ya bohlweki ba molomo, e seng feela ho qetella ho ntlafaditswe palo ya meno a tlatswang mme ka ho etsa jwalo ho fokotswe palo ya meno a ntshwang le ho utlwisa batho bohloko. Ho hlokahala tshehetso ya ditjhelete ka ho kgetheha bakeng sa ho ruta setjhaba mekgwa e metle ya tlhokomelo ya bohlweki ba molomo, ya ho etsa menyetla ya ho baballa meno le ntlafatsa tlhokomelo ka kakaretso ya molomo. Haeba maemo a leng teng hona a sa thabiseng a tswela pele, ho na le menyetla e fokolang ya hore ditshebeletso tsa tlhokomelo ya bohlweki ba molomo di ntlafale. Empa haeba maemo a fetoha, ART e ka ba mokgwa o loketseng haholo wa ho hlokomela meno o thibelang ho bola le wa ho a tlatsa o ka sebediswang. Ho bonahala eka, hase ho tswa patlisisong ena ya PhD feela empa le tse ding tse etswang maemong a sa tshwaneng le dinaheng tse

sa tshwaneng, hore ha ho tluwa tabeng ya hore tlatsa meno a bodileng bakudi ba rata mokgwa wa ART ho feta wa ho fata le ho tlatsa o tsamayang le ho bolawa sebakeng seo leino le sebetswang ho sona. Ho lokela ho nahanelwe haholo ka kgetho ena nakong e tlang.

Leha ho le jwalo, le hoja tshebediso ya ART e sisintswe ditshebeletsong tsa setjhaba tsa tlhokomelo ya bohlweki ba molomo, ho lokela ho totobatswe hore ntho e ka sehloohong e ka thusang ho ntlafatsa tlhokomelo ya molomo ke thutong ya tlhokomelo ya bohlweki ba molomo le ho kgothalletsa hore sena se tswele pele metseng le naheng ka bophara. Mehopolo e kang Ditshebeletso tsa Motheo tsa Tlhokomelo ya Molomo [*Basic Package of Oral Care*] (BPOC), a hatisang tlhwekiso ya molomo le tshebediso ya *fluoride* e ka fumanwang ka ho sebedisa sesepa sa meno se kentsweng *floride,* ho phaella mokgweng wa ART, a lokela ho kgothaletswa. Mekgwa e atlehang ya ho thibela ho bola ha meno le tsebo e ntlafaditsweng ya tlhokomelo ya molomo le tlhwekiso ya molomo hara dihlopha tsa batho ba dikobo-di-mahetleng setjhabeng e ka thusa ho fokotsa ho bola ha meno mme kahoo, ho ba le ho fokotsa ha tekanyo e phahameng haholo ya meno a hlokang ho alafuwa ka ho tlatswa. Ka lehlakoreng le leng, sena se tla thusa ho fokotsa *palo e sekgahla ya bakudi/ bongata ba mosebetsi* wa letsatsi le letsatsi wa dingaka tsa meno tsa Afrika Borwa tsa ditshebeletso tsa setjhaba tsa tlhokomelo ya bohlweki ba molomo.

Patlisiso ena ya PhD e bontshitse hore thupello e le nngwe ya ART e ke ke ya tshepelwa hore ka yona ho ke kenyelletswa ART ditshebeletsong tsa setjhaba tsa tlhokomelo ya meno ya profinseng ya Afrika Borwa. Tshobotsi ya ART ya ho se namele dibakeng tse ding haholo le ho se itshetlehe ha eona ka tshebediso ya motlakase le thepa ya yona ya meno e turang, le hoja e le ditshobotsi tsa bohlokwa tsa mokgwa ona wa ho alafa, e ne e se tiiso ya hore ART e ne e tla sebediswa ka mora hore dingaka tsa meno di kwetliswe thupellong ya ART ya matsatsi a 3. Ho ne ho na le mabaka a mangata haholo ditshebeletsong tsa setjhaba a neng a thibela tshebediso ya ART.

Chapter 8

Annex

Annex 1: Operator questionnaire on patient load and stress

	Item
General	Type of operator occupation and place of clinic
	Operator age
	Operator gender
	Year of graduation of operator
	School were operator has graduated
	Years working in present clinic
1. Patient load / work load	How many patients do you treat per day?
2. Operator stress	What is your level of occupational stress, rated on a scale ranging from 1 = 'no stress' to 10 'intense stress'?
3. Stress reason	What do you perceive as the main reason for stress in your clinic?
	1. Dental assistance
	2. State of dental facilities
	3. Patient anxiety
	4. Patient load

Annex 2: Operator questionnaire on ART utilisation

	Item
General	1. Type of operator occupation
	2. Years working in the MDU
Operator choice of treatment type	What is your preferred type of treatment for carious single – or multiple-surface lesions?
	3. For primary teeth:
	4. For permanent teeth:
Reasons for choice of treatment	5. Please state the reason for your treatment of choice:

Annex 3: CFSS-SF questionnaire to assess fear for patients (under 16 years)

ITEMS: Are you afraid…	NOT AT ALL	A LITTLE	FAIR AMOUNT	PRETTY MUCH	VERY AFRAID
… of dentists?					
… of injections?					
… of the dentist filling your tooth?					
… of the sight of the dentist filling your tooth?					
… of the noise of the dentist filling your tooth?					
… of having somebody put instruments in your mouth?					
… of going to the dental clinic?					
… having the dentist clean your teeth?					

Annex 4: DAS questionnaire to assess fear for patients (from age 16 years)

1. If you had to go to the dentist tomorrow, how would you feel about it?

- I would look forward to it as a reasonably enjoyable experience. O
- I wouldn't care one way or the other O
- I would be a little uneasy about it O
- I would be afraid that it would be unpleasant and painful O
- I would be very frightened of what the dentist might do O

2. When you are waiting in the dentist's office for your turn in the chair, how do you feel?

- Relaxed O
- A little uneasy O
- Tense O
- Anxious O
- So anxious that I sometimes break out in sweat or almost feel physically sick O

3. When you are in the dentist's chair waiting while he gets ready to begin working on your teeth, how would you feel?

- Relaxed O
- A little uneasy O
- Tense O
- Anxious O
- So anxious that I sometimes break out in sweat or almost feel physically sick O

4. You are in the dentist's chair to have your teeth filled. While you are waiting and the dentist is getting out the instruments, which he will use to fill your teeth, how would you feel?

- Relaxed O
- A little uneasy O
- Tense O
- Anxious O
- So anxious that I sometimes break out in sweat or almost feel physically sick O

Annex 5: Questionnaire used to assess possible barrier factors

	Item
General	Type of operator occupation and place of clinic
	Operator age
	Operator gender
	Year of graduation of operator
	School were operator has graduated
	Years working in present clinic
Barrier factors	*Operators were asked to indicate whether they "strongly agree", "agree", are "undecided", "disagree" or "strongly disagree" with the following statements:*
1. Patient load / work load	I have to treat too many patients during the day
	I have no time to do ART in my clinic
	ART fillings take longer to do than amalgam or composite fillings.
2. Operator opinion	I have attended the ART course and I find applying ART in the public clinic an effective service for patients
	When I do fillings, I prefer to use the drill, because I find it easier
	I consider ART an inferior treatment option as compared with other restorations
	I feel a sense of accomplishment when I am able to restore a tooth
	I feel better when I do not have to give a local anaesthetic.
	I feel a sense of accomplishment when I do not have to drill when preparing a cavity
	I prefer to use the drill because it is much quicker
	I prefer to use the drill because it is better
	I would like to spend more time rendering ART in my clinic
3. Patient opinion	In my clinic, patients prefer tooth extraction to restorations
	In my clinic, patients prefer ART to other tooth restorations
	My patients are very grateful and satisfied, if I restore their teeth using the ART technique.
	My patients are very grateful and satisfied, when I don't have to inject them.
	My patients are very grateful and satisfied, when I don't have to drill their teeth
4. *Oral health service management*	My clinic manager fully understands the concept of ART
	My clinic manager fully supports ART in our clinic
5. *Material supply*	I have a constant and adequate supply of ART materials to my clinic
	I have sufficient instruments available in my clinic, in order to render ART
6. *Clinical ART skill*	I have had adequate training, in order for me to feel confident when rendering ART
	I would like to have more training in the theoretical aspect of ART
7. Chair-side assistance	My chairside assistant is skilled to assist me in rendering ART

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